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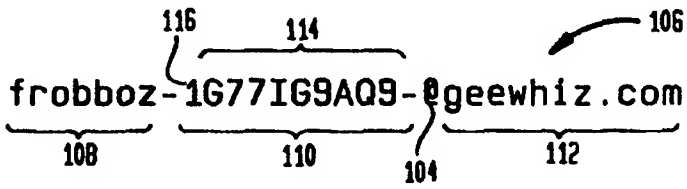

(57) Abstract

A system and method is provided for sending and receiving authorized messages from a sender to a recipient in a network. The method and system makes use of a channelized address to send the message from the sender to the recipient. The channelized address comprises a common address portion that indicates the identity of the recipient in the network and a channel identifier portion for verifying that the message is authorized for delivery to the recipient.

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COMMUNICATIONS ADDRESSING SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to communications sent over a communication network, and more particularly, to a system and method for controlling the reception of communications from various entities having access to the network.

Description of the Related Art

Electronic mail ("e-mail") has become increasingly popular as a form of communication in today's society. This is true at least in part due to the popularity of the Internet. Users of e-mail may be referred to as "users". The user is generally referred to as a "recipient" when receiving e-mail and as a "sender" when sending e-mail to a recipient. The term "correspondent" may be used to refer to a person or persons who are sending e-mail to, or receiving e-mail from, the user in question.

To send e-mail over a communications network, a user must address an e-mail message to an intended recipient. For example, referring to FIG. **1A**, a conventional e-mail address as used on the Internet is illustrated. The address usually has two parts, the user name **100** (also referred to as the "mailbox name") and the host (or domain) name **102**. These two parts are part of a hierarchy of names; that is, the domain name **102** is of a higher level than the user name **100**. The user name **100** may be described as the lowest-level name in the hierarchy. Typically, the user name **100** and the host name **102** may be separated by an "at" sign, "@", **104**. To send e-mail over the Internet, the user addresses the e-mail message by placing the intended recipients' addresses in the "To" line (or field) of the message as is well know in the art. In addition, a user may "carbon copy" or "cc" (or "Cc") yet another intended recipient of the e-mail message by placing that recipient's address in the cc line (or field) as is also well known in the art. There is also typically a "from" line (or field) indicating who sent the message. All of these items together with other lines such as subject, date, etc., form what is known as a "header" of the e-mail message. Other options, also well known in the art, are available for various ways to address intended recipients of Internet e-mail. Analogous methods exist for addressing e-mail over other networks.

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Unfortunately, as with other forms of communication, for example regular mail and facsimile, users of e-mail may receive a quantity of unwanted or "junk" mail. This may be in the form of "telemarketing" type e-mail (for example an advertisement or a survey). While this may only rise to the level of a mere nuisance or annoyance, in some situations, unwanted e-mail may actually rise to the level of harassment. For example, the user may receive unwanted offensive or obscene e-mail. A malicious e-mail sender could also possibly send "hate mail".

This type of activity, in some circumstances, may as a practical matter render the user's e-mail capabilities useless. For example, if a malicious e-mail sender barraged the e-mail user's mail box with a multitude of messages that the user would have to review, any wanted, or "non-junk" mail would be buried in a large amount of useless junk e-mail. The malicious e-mail sender could also send messages that were known to offend the recipient so that the recipient would not want to review any of the messages received, including legitimate messages.

The commercialization of the Internet further threatens the usefulness of e-mail. Today, it is easier than in the past to collect address lists and inexpensive to mass-distribute messages. Every time a user sends a message to a public newsgroup or list, fills out a web form, or mails in a product registration card, the server inexpensively obtains an e-mail address and typically some indication of the user's interests. This information can then be sold to marketing firms who can easily automate unsolicited mass e-mailings of advertisements, surveys, and other annoyances that may cost the user connect time and, possibly worse, valuable attention span.

It would be desirable to be capable of restricting the receipt of unwanted e-mail and other types of messages sent over a network. In addition, when unwanted e-mail (or messages) is received, it would be beneficial to be able to determine in what manner the sender of the unwanted e-mail obtained the user's address.

One way to restrict unwanted e-mail is for the user to limit who he gives his e-mail address to. This is analogous to having an unlisted telephone number. Alternatively, a user might maintain multiple e-mail accounts, using different accounts for different purposes, such as one address for business purposes and another address for personal purposes. This "unlisted address" approach may be expensive and slow to recover

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from security breaches. For example, if an address that was supposed to be kept secret is leaked to a malicious e-mail sender (also referred to as an "adversary"), the "secret" address is no longer secret. The only way to stop this leak may be to pay a fee to the service provider to change the address. This may be a lengthy process and, once the address is changed, the user must attempt to notify all legitimate correspondents of the change while keeping it from the adversary.

Another approach to solving these problems is through the use of "kill files". This is accomplished by simply discarding all messages from a predetermined user, site, or even domain. Killing a site or domain prohibits messages from all of its users, even though only a subset may be undesirable. Undesirables can have other accounts with completely different addresses, or may forge messages in order to evade simple address checks such as these.

In addition to kill files, another prior art approach is to use an e-mail filter to discard undesired messages. This would include messages that do not satisfy user-defined criteria. A filter works by searching for syntactic patterns and eliminating (or filtering) messages that match. However, it is extremely difficult to define syntactic rules that can reliably distinguish advertisements and surveys from legitimate messages. For example, if the following message were received from an individual, a filter may assume that it is a legitimate question from a friend and fail to filter it out:

> "Dear Bob, I have difficulty using software package X. It never seems to run in a multitasking environment! Isn't this frustrating? Do you have the same problem? Maybe you should check out software package Y which will eliminate the problem. Talk to you soon, John"

This message, upon an initial review, appears to be a legitimate question and suggestion sent to "Bob". This could also represent a ploy by "John" to advertise a software package Y. It would be extremely difficult to write an e-mail filter that discards this message but lets through legitimate messages.

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Another prior art method of restricting access to e-mail is cryptographic authentication. With this method, access is controlled by requiring all messages to be digitally signed by an authorized correspondent. A cryptographic filter would discard any unsigned or unauthorized messages. This approach may provide protection against unauthorized messages. However, even though software packages exist to do the cryptographic operations necessary (for example PGP ["pretty good privacy"] available over the Internet from the Massachusetts Institute of Technology [see the World Wide Web Page located at http://web.mit.edu/network/pgp.html] or products that comply with S/MIME, which is a specification for secure e-mail [information about S/MIME may be obtained on the World Wide Web page "S/MIME Central" at http://www.rsa.com/rsa/S-MIME/]), reliably obtaining a public key of a correspondent is still problematic in that the public key transfer itself must also be digitally signed, which requires reliably knowing the signing key for that message. In addition, this method does not solve the problem of allowing messages from previously unknown correspondents, such as messages received from mailing lists. If the user wishes to be able to receive such messages, he must publish a single address. Even if a message to that address is digitally signed with a certified key, there is no guarantee that the message is not junk.

Yet another alternative is to accumulate a list of individuals who send junk e-mail, but adversaries may be able to evade this mechanism by registering several addresses and keys, or by having a different employee send each message.

There are also existing methods of augmenting the user name portion of an e-mail address. For example, the Andrew Message System, as described in Nathaniel S. Borenstein and Chris A. Thyberg, Power, ease of use and cooperative work in a practical multimedia message system, International Journal of Man-Machine Studies, Volume 34, Number 2, pages 229-259, February 1991, uses addresses of the form "user+info@host". Each user may write code in the Andrew Message System FLAMES language to process messages based on the content of the "info" field. For example, "urgent" may be placed in the info field indicating that incoming messages are urgent. With this system, it is up to

the good will of the correspondent to not purposefully mischaracterize messages, for example by sending junk mail while using "urgent" in the "info" field. The "info" field is typically well-known, predictable or easily guessable.

Therefore, there is a need for an effective way of preventing undesirable e-mail and other network communications or messages. There is also a need for the ability to trace unwanted or undesirable e-mail (and communications or messages).

SUMMARY OF THE INVENTION

The above mentioned shortcomings are overcome and a technical advance is made over the prior art through the system and method of the present invention. In a first aspect, the invention features a method for sending a message from a sender to a recipient in a network. The method comprises the step of using an address to send the message from the sender to the recipient. The address comprises a common address portion that indicates an identity of the recipient in the network and a channel identifier portion for verifying that the message is authorized for delivery to the recipient.

In another aspect of the invention, an improved address of the type having a hierarchy of names including a lowest-level name at the lowest level of the hierarchy is provided. The improved address comprises a channel identifier part of the lowest-level name that includes at least a substantially unguessable channel identifier.

In another aspect of the invention, a system for authenticating a received message from a network is provided. The system comprises a mail server for receiving and authenticating the message. A file is available to the mail server for determining whether the message is an authorized message. This determination is based upon a substantially unguessable portion of the address attached to the message.

In another aspect of the invention, a system is provided for sending a message on a network to a recipient. The system comprises a personal channel agent for automatically including a substantially unguessable portion in a recipient's address so that the recipient can determine whether the message is an authorized message that the recipient will receive.

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In another aspect of the invention, a method of sending and receiving messages from one or more first correspondents to a second correspondent is provided. The method comprises the steps of: (1) the second correspondent forming a plurality of substantially unguessable extended addresses for messages sent from the first correspondent to the second correspondent; and (2) providing a received message to the second correspondent only if an address to the second correspondent associated with the received message matches one of the plurality of extended addresses.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing features and other aspects of the invention are explained in the following description taken in connection with the accompanying drawings, in which like reference characters refer to like parts throughout, and wherein:

FIG. 1A is a diagram of a conventional e-mail address;

FIG. 1B is a diagram of a channelized address according to an embodiment of the present invention;

FIG. 2 is a block diagram illustrating a system configured according to an embodiment the present invention;

FIG. 3 is a block diagram illustrating a system configured according to an embodiment of the present invention;

FIG. 4 is a diagram illustrating a database used in connection with the system shown in FIG. 2;

FIG. 5 is a diagram illustrating a file used in connection with the system shown in FIG. 2;

FIG. 6 is a flow diagram illustrating the process of receiving an e-mail message;

FIG. 7 is a flow diagram illustrating the process of sending an e-mail message;

FIG. 8A is a diagram illustrating an e-mail message according to an embodiment of the present invention;

FIG. 8B is a diagram illustrating an e-mail message according to an embodiment of the present invention.

FIG. 9 is a flow diagram illustrating the process of switching e-mail channels;

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FIG. 10A is a diagram illustrating a message according to an embodiment of the present invention;

FIG. 10B is a diagram illustrating a message according to an embodiment of the present invention;

FIG. 10C is a diagram illustrating a message according to an embodiment of the present invention;

FIG. 10D is a diagram illustrating a message according to an embodiment of the present invention;

FIG. 10E is a diagram illustrating a message according to an embodiment of the present invention;

FIG. 11 is a diagram illustrating an interface according to an embodiment of the present invention;

FIG. 12 is a block diagram illustrating a system for using Packet Telephony configured according to other embodiments of the present invention;

FIG. 13 is a flow diagram illustrating the process for receiving a call on the system shown in FIG. 12; and

FIG. 14 is a flow diagram illustrating the process for placing a call on the system shown in FIG. 12.

DETAILED DESCRIPTION

A preferred embodiment of the present invention utilizes "channelized addresses" to allow correspondents to send and receive e-mail. Channelized addresses create different "channels" that correspondents can use to send e-mail to the user. In other words, each user's e-mail account is made accessible via a user-controlled set of channels. Each channel has a distinct structured e-mail address that contains within it the account name and a cryptographically unpredictable or "unguessable" random string, known as a "channel identifier." Each legitimate correspondent is allowed to know one or more of these access addresses or channel identifiers.

The system according to the invention allows the user to reject any e-mail not arriving on a proper channel (with a proper channelized address). If unwanted e-mail does arrive on a valid channel, the user may turn the channel off and allow legitimate users of that channel to use another channel. In other words, legitimate users are "switched" to another channel.

The user (or account owner) is provided simple controls for opening a new channel, closing a channel (hence possibly retracting one or more correspondent's access privilege), and switching a channel (notifying selected correspondents that the current channel is being closed, but a new one is open for their use). This can be provided through an automated personal channel agent ("PCA"). The PCA also causes the received channelized e-mail to look and feel to the user exactly like conventional e-mail. The PCA provides various administrative controls. The PCA manages a database that maps a correspondent's address to its assigned channel, as well as (when applicable) the channel assigned by the correspondent to the account owner.

Referring to FIG. **1B**, a "channelized address" **106** according to a preferred embodiment is shown. This address is in the standard Internet domain name format. This format usually consists of a hierarchy of names, the domain name being of a higher level and the user name being of a lower level in the hierarchy. It should be understood that other known address formats can also be used. Indeed, virtually any address format that has a user name part may be used.

The channelized address **106** in FIG. **1B** comprises at least three basic parts, the user name **108**, the channel identifier (or channel ID) **110**, and the host (or domain) name **112**. Between the channel ID **110** and the host name **112** is an "at" sign, "@", **104**. As shown in FIG. **1B**, there is a hyphen ("-") immediately before and immediately after the channel ID **110**. By comparison of FIG. **1A** with FIG. **1B**, it should be noticed that the prior art address (FIG. **1A**) is somewhat similar in appearance to the channelized address of the preferred embodiment (FIG. **1B**), except that the channelized address of the preferred embodiment contains the channel ID **110** to the left of the "at" sign **104**. Thus, the channelized address **106** contains both traditional address information (e.g., user name **108** and host name **112**), as well as the channel ID **110**.

In a preferred embodiment, the administration of the channelized addresses **106** and the generation of the channel ID **110** are accomplished by a personal channel agent (or administrator) ("PCA"), which is described below in more detail with respect to other functions it performs.

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Each channel identifier **110** comprises at least two parts, a security string **114** and a channel class indicator **116**. The channel class indicator **116** is an ASCII code for a digit indicative of a channel class. In a preferred embodiment, the security string **114** causes the channel identifier **110** to be practically unguessable (or even random), even when a malicious e-mail sender (or adversary) is aware of several of the user's other preexisting channel identifiers. That is, the channel identifier **110** should be unpredictable by an adversary. The security string **114** may be generated pseudorandomly. In alternate embodiments, the security string **114** may be generated randomly or selected by a user. Again, the important point is that the security string **114** be practically unguessable by an adversary, no matter how it is generated.

One method to generate random bits to be used in the security string **114** in a preferred embodiment is using the cryptographically unpredictable generator of Blum Blum and Shub ("BBS generator"), with a modulus size larger than 1024 bits (for example 1046 bits may be used in one embodiment). This method is disclosed in L. Blum, M. Blum, & M. Shub, A Simple Unpredictable Pseudo-Random Number Generator, Society for Industrial and Applied Mathematics Journal on Computing, Volume 15, No. 2, pages 364-383, May 1986, which is hereby incorporated by reference herein. Once the random bits are generated, they cannot simply be inserted into an e-mail address because typical e-mail protocols, including the Internet mail protocol, restrict the set of characters allowed in an address. Thus, to generate the security string **114** of a new channel ID **110**, the system preferably first generates 45 random bits using the BBS generator method. These bits are then encoded into strictly alphanumeric ASCII characters 5 bits at a time, using only one case of the alphabet and the digits 3 through 8. (For example, in one embodiment, binary numbers 00000-11001 are mapped to uppercase letters A-Z respectfully and binary numbers 11010-11111 are mapped to numerals 3-8 respectively.) The reason for this is that when a message is received on a channel, alphabetic case is ignored in comparing the channel ID **110** in the channelized address **106** of the message to those of active channels. Using this method, by way of example, if a user maintains 128 (2^7) open channels, an adversary has approximately one chance in 2^{45-7} (about 275 billion) of guessing an open

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channel with one message. A brute force attack (sending 100 billion messages to the same host) is impractical in today's Internet.

Although generation of the security string **114** using the cryptographically unpredictable BBS generator method has been described as a preferred method, other possible random bit generators that are practically unpredictable could also be used.

The other part of the channel ID **110**, the channel class indicator **116**, gives an indication of how mail on that channel will be treated by the user/recipient. In a presently preferred embodiment, there are three classes of channels indicated by the channel class indicator **116**: channel class 0 indicates a send-only channel, channel class 1 indicates a private channel, and channel class 2 indicates a public channel. These various classes are indicated in FIG. **1B** by reference number **116** at the beginning of the channel ID **110**. Thus, in the example illustrated in FIG. **1B**, the channel class indicator **116** is set to "1", indicating a private channel.

A send-only channel (channel class 0) is one that is permanently closed to incoming e-mail. This may be useful when a user wants to send a message to a public or adversarial address without providing the recipient with any access channels or addresses to which the recipient could send unsolicited e-mail. A private channel (channel class 1) is used when the user expects only one or a limited number of known or identified correspondents to send e-mail on that particular channel. A public channel (channel class 2) allows previously unknown correspondents to send on it.

One purpose for explicitly identifying the channel class indicator **116** in the channel ID **110** is as a courtesy to correspondents. Once a correspondent notices which channel is open for her use, she can determine her response options. For example, the correspondent will not bother trying to send a return message on a send-only channel (channel class 0).

Although three channel classes have been described herein, it is understood that any number of user-defined channel classes may be used. For example, as an alternative to the channel classes described above, the following classes could be implemented: channel class 0 for a send only channel; channel class 1 for a private channel; channel class 2 for a

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permanent public channel; channel class 3 for a temporary public channel; channel class 4 for a commercial channel; and channel class 9 for an introductory channel. A permanent public channel (channel class 2) is open for an unlimited time, whereas a temporary public channel (channel class 3) is open for a limited predetermined time. A commercial channel (channel class 4) may be used for commercial traffic.

In an embodiment with an introductory channel (channel class 9) (or alternatively, any public channel class), the introductory channel may be configured as a public, "pay-per-view" channel having a well-known address. Each channel user may use a powerful filtering agent (for example the Andrew Message System's FLAMES language discussed above) to establish a well-known public channel identifier, for example "9INTRODUCE". If a message to this channel does not contain an electronic money (or "e-money") payment, such as electronic checks or cash, of some reasonable fee (for example, $1.00), then the system could send an automatic message informing the correspondent that the user will not read the message unless the proper fee is forwarded. The reply would also inform the correspondent that, if after reading the message, the correspondent is found to be "friendly", or non-commercial (e.g., not "junk" e-mail), the fee will be refunded by the user. If the message is retransmitted and determined by the user to be junk or otherwise inappropriate, then the user may retain the fee. Alternatively, if the retransmitted message is a legitimate attempt at contact, the user refunds the fee. Such a channel address could be published in directories. The risk of unwanted e-mail is reduced by setting an appropriate access fee for unknown correspondents since there is presumably a price that advertisers will not pay for mass-mailings. This approach allows access to long-lost friends and relatives since the fee will be immediately refunded in the case of a "friendly" correspondent.

A user may allocate a number of the channelized addresses **106** having differing channel identifiers **110** for different correspondents. Other than the channel ID portion of the channelized address, the address may look the same for all correspondents. If a correspondent desires to send e-mail to the user, the correspondent must send the e-mail identifying the correct channel; that is, by using an open (or active) channelized

address **106** with the proper channel identifier **110**. If the correspondent sends to a channel that has not been opened or that has been closed as is described below, the e-mail from the correspondent will be rejected by the user's mail server and the user will never receive it. A goal is thus to control access to a user's mailbox by potential correspondents, not to ensure anonymity of the account owner/user, or to guarantee privacy of the messages.

Referring now to FIG. **2**, the architecture for an embodiment implementing the system is illustrated. The hardware involved is connected to a network **200** for sending and receiving e-mail. This network may be the Internet, or any other network capable of transferring e-mail.

Connected to the network **200** is a mail server **202**. In a preferred embodiment, this can be implemented with a Sun Work Station, and in particular a Sparc Station 2, available from Sun Microsystems running a UNIX operating system. It is understood, however, that other suitable computers may be used as the server **202**.

The server **202** is connected to a personal channel agent host ("PCA host") **204**, which is a computer that acts as a host machine for the personal channel agent ("PCA") **214**. In a preferred embodiment, the PCA host **204** can be implemented with a Macintosh IIfx, available from Apple Computer, running a MAC OS operating system. It is also understood that other suitable computers could be used as the PCA host **204**. The PCA **214** may be implemented in software code written, for example, in the Common Lisp language. It is also understood that the PCA **214** could be implemented using other software languages and also in hardware or in a combination of hardware and software.

The PCA host **204** is connected to a user machine **206**. The user machine acts as the user interface to the network **200** for sending and receiving e-mail. In a preferred embodiment, the user machine **206** may be implemented with a personal computer, for example a Dell Pentium 90, available from Dell Computer Corporation, running a Windows 95 operating system available from Microsoft Corporation. It is understood that other suitable computers could be used for the user machine **206**.

Within the mail server **202** is a mail receiver **208** and a mail sender **210**. The mail receiver **208** and mail sender **210** can be implemented using a modified form of the Unix "Sendmail" program. In

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particular, the Sendmail program is modified as described with respect to steps **604** and **608** shown in FIG. **6**. The mail receiver **208** is a "daemon" program. In other words, the mail receiver **208** constantly checks to determine whether any mail has arrived from the network **200**. Preferably, the mail receiver **208** receives e-mail from the network **200** on path **220** using the Simple Mail Transfer Protocol ("SMTP"), although other conventional formats could also be used. The mail sender **210** preferably sends mail to the network **200** on the path **222** using the SMTP protocol, although other conventional formats could also be used. In the SMTP protocol, a message is transmitted with an envelope that specifies the sender and the recipient(s). The message itself comprises header lines (to, from, subject, date, etc.) followed by a blank line followed by the body of the message. The server **202** also contains a channels file **212**, which is described below.

Within the PCA host **204** is the PCA **214**. The PCA **214** receives mail from the mail receiver **208** via path **216**. The PCA **214** is configured to periodically check the mail server **202** for new e-mail. Path **216** preferably uses the POP3 protocol to transfer the e-mail from the mail receiver **208** to the PCA **214**. The POP3 protocol is enabled by running a software product, such as "POPPER" (which can be obtained from the Internet at ftp.CC.berkeley.edu) on the mail server **202**. Other known implementations of the POP3 protocol, as well as other known protocols, could also be used. The PCA **214** also forwards e-mail to the mail sender **210** via path **218**. Path **218** preferably uses the SMTP protocol to transfer e-mail from the PCA **214** to the mail sender **210**. Other known protocols could also be used on path **218**. The PCA **214** also transfers data via path **224** to the channels file **212**. In a preferred embodiment, this data is transferred using the File Transfer Protocol ("FTP") along path **224**. Of course, other known protocols could be also used. The PCA **214** also has a User Channel Database ("UCDB") **226**, which is described below.

Within the user machine **206** is a mail client **228**. In a preferred embodiment, the mail client **228** may be implemented with the Netscape Mail Client and Browser available from Netscape Communications Corp. Of course, other well known mail clients could also be used. The mail client **228** communicates with the PCA **214** via paths **230** and **232**. Path **230** is preferably used for receiving e-mail from the

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PCA **214** using the POP3 protocol. Path **232** is preferably used for sending e-mail from the mail client **228** to the PCA **214** using the SMTP protocol. Although paths **230** and **232** have been described using the POP3 and SMTP protocols, respectively, other known protocols may also be used.

Also within the user machine **206** is a web browser **234**. In a preferred embodiment, the web browser **234** could be implemented with the Netscape Navigator provided by Netscape Communications Corp. The web browser **234** is used to administer the PCA **214** including the UCDB **226**. The web browser **234** preferably communicates with the PCA **214** along path **236** using the Hypertext Transfer Protocol ("HTTP"), although other known protocols may also be used.

Other combinations of a user machine **206a**, PCA host **204a**, and mail server **202a**, may also be connected to the network **200**. Their configuration may be the same as that described for the combination of user machine **206**, PCA host **204**, and mail server **202**. In FIG. **2**, the interconnections and components of combination **206a**, **204a**, and **202a** are the same as described for combination **206**, **204**, and **202**. To illustrate this, components in combination **206a**, **204a**, and **202a** are labeled with reference numerals corresponding to those in combination **206**, **204**, and **202**, except that the suffix "a" is added at the end of each reference number. For instance, PCA **214** in combination **206**, **204**, and **202** corresponds to PCA **214a** in combination **206a**, **204a**, and **202a**. Corresponding components may be described in like fashion.

Although, FIG. **2** illustrates connections for two user machines **206** and **206a**, it is understood that, as with any network, many other machines may be connected to the network **200** for sending and receiving e-mail. As illustrated in FIG. **3**, many user machines **206**, **206a**, **206b**, **306a**, **306b**, **306c**, **306d**, **312a**, **312b**, **312c**, and **312d** may be connected to the network **200**. In addition, while the preferred embodiment has been illustrated in FIG. **2** as having one user machine **206** and one PCA host **204** used with one mail server **202**, it is understood that in other embodiments, more than one user machine may be connected to a single PCA host. In FIG. **3**, two different configurations for connecting multiple user machines to a server are shown. In one embodiment, separate PCA hosts **304a** and **304b** may be provided for connecting each corresponding user machine **306a** and **306b** to a single mail server **302**. In another

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embodiment, a single PCA host **310** may be used for connecting multiple user machines **312a**, **312b**, **312c**, and **312d** to the mail server **308**. This is also shown by user machines **306c** and **306d** connected to a single PCA host **304c** and to the mail server **302**.

Referring to FIG. **2**, conceptually, the PCA **214** acts as an e-mail proxy, sitting between the user's mail client **228** and the mail server **202**. Thus, all incoming and outgoing messages pass through the PCA **214**, which uses appropriate protocols as discussed above to interact with the mail client **228** and mail server **202**. This positioning allows the PCA **214** to autonomously perform various bookkeeping functions, thereby shielding the user from them.

The architecture described above and illustrated in FIG. **2** allows the PCA **214** to run on a PCA host **204** separate from the mail server's host **202** so that any additional computational load incurred by the PCA **214** can be appropriately distributed. The only additional load necessarily incurred by the mail server **202** when the PCA **214** is on its own host **204** is in parsing the address (dividing the channelized address into a user name and a channel ID), plus the time to check the channels file **212** as will be described below. This is only significant for large channels files or slow file access. If users want to keep open many channels, the file **212** may be compiled by the PCA **214** into a format supporting faster access than a flat file, which is used in one embodiment.

Although FIG. **2** (and FIG. **3**) illustrate a preferred embodiment where the PCA **214** is located on a different piece of hardware (PCA host **204**) than the server **202** and user machine **206**, it is understood that the PCA **214** could alternatively be located on the user machine **206** or on the server **202**, thus eliminating the need for the PCA host **204**.

The user channel database (UCDB) **226** primarily records two mappings, the channel map and the correspondent address map. The channel map associates each correspondent with the channel on which the user expects to receive mail from that correspondent. The correspondent-address map associates each correspondent's user and host names with the channel ID (if one exists) on which the user is allowed to send to the correspondent.

The UCDB **226** (or **226a**) is conceptually illustrated in FIG. **4**. The headings in each column are not actually stored in the database **226**,

but are provided in FIG. **4** for illustrative purposes. For each correspondent address **402**, the UCDB **226** may have one or more of the following entries: own channel **404**, correspondent channel **406**, own key **408**, and correspondent key **410**. A correspondent is simply another e-mail user that the user desires to send to or receive mail from. The correspondent address **402** is the standard e-mail address of the correspondent. The own channel **404** is the channel ID **110** used for the correspondent to send e-mail to the user. The correspondent channel **406** is the channel ID **110** that must be used by the user to send e-mail to the correspondent. The own key **408** is a key assigned by the user that is necessary to allow certain functions to be performed (as will be discussed below). The correspondent key **410** is a key assigned by the correspondent, which is also necessary to allow certain functions to be performed (as will also be discussed below). All of this information is placed in the UCDB **226** by the PCA **214** as it interacts with the mail server **202** and the user machine **206**.

So, for example, as illustrated in FIG. **4**, for the correspondent address **402** "frobboz@geewhiz.com", the following information is stored in the UCDB **226**: own channel **404** = 1QXR7112PH; correspondent channel **406** = 1DDYWA7H7I; own key **408** = X9GWAAH4T; and correspondent key **410** = T7AA18MMN. For the correspondent address **402** "jrandom@j.r.isp.net", all of the entries are similarly filled except for the correspondent key entry **410**. This is because the correspondent key information has not yet been received from the correspondent, possibly because it is not yet needed. Nevertheless, the UCDB **226** can store this correspondent key information when (and if) it is received.

The first two own channels **404** listed in FIG. **4**, "1QXR7112PH" and "122PG3LWAW", begin with the number "1". This number is the channel class indicator **116** discussed above and preferably indicates (because it is set to "1") that these are private channels as described above. The next two own channels **404** listed in FIG. **4**, "2AA47WX3BQ" and "2BZZ86A9FC", begin with the number "2". This channel class indicator **116** identifies these channels as public channels as described above. Therefore, these two channels do not require entries for correspondent address **402**, correspondent channel **406**, own key **408**, or

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correspondent key **410**, because any one of a number of correspondents may send e-mail on these public channels (using the public channel ID). The correspondent channel **406** associated with the correspondent address **402** "info-hooha@sri.com" shown in FIG. **4** is "0XTRR9Y680". Because this channel class indicator **116** begins with the number "0", this indicates that this channel is a send-only channel as described above. Therefore, there is no need for an entry for correspondent channel **404** or correspondent key **410** because no return messages will be accepted on this channel from any correspondent. In one embodiment, there is an own key entry **408** (in this case "BZTGRTKI3") because the system automatically generates an own key every time a new correspondent is entered into the UCDB. In the case of a send-only channel, this key would not be used.

In FIG. **4**, a correspondent address such as "jrandom@j.r.isp.net" may have no entry for the correspondent channel field **406** if that correspondent does not use channelized addresses. In other words, that correspondent expects e-mail addresses as shown in FIG. **1A**, or whatever the standard format is for that system.

Referring again to FIG. **2**, the mail receiver **208** and mail sender **210** may be implemented in a preferred embodiment using a modified Unix "Sendmail" mail transfer program. It is understood that other mail transfer programs could also be used if analogous changes are made thereto. The modification involves changing the sendmail code so that when Sendmail is about to look up a user's name in the system's password file (a standard database defining the valid users of the system), it will first separate the address into a "true" user name and channel ID. Then, assuming the normal password file check succeeds for the true user name (FIG. **6**, step **604**, discussed below), the corresponding user's home directory is checked for a channels file **212** containing a list of open channels (FIG. **6**, step **608**, also discussed below). If the channel ID of an incoming message matches one of the lines in the channels file **212**, the message is delivered to the user machine **206** through the PCA host **204**. If the channels file **212** does not have a match, the message is refused with a "no permission" error. The message is also rejected if the address has no channel ID at all. The channels file **212** must be readable and writable only by the user and the Sendmail program to prohibit others from gaining unauthorized knowledge of open channels.

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Referring now to FIG. **5**, a conceptual diagram of the channels file **212** is illustrated. The heading on the column "Open Channels" is illustrative only, and such a heading is not actually stored in the channels file **212**. The channels file **212** has a list of channels **501** that have been open by the user. Opening channels may be accomplished with a user interface as described with reference to FIG. **11**. In the example shown in FIG. **5**, the first channel listed is "1QXR7112PH". These channels are checked by the modified Sendmail program when a message is received by the mail receiver **208**. The channels file **212** is updated regularly by the PCA **214** from information that has been entered in the UCDB **226**. This information is stored in the own channel field **404** of the UCDB, as shown in FIG. **4**.

Referring now to FIG. **6** (with reference also to FIG. **2**), the process of receiving a message will be described. In step **602**, the mail server **202**, through the mail receiver **208**, receives a message from the network **200**. The mail receiver **208** is implemented using the modified Sendmail program. In step **604**, the system determines whether the recipient's address (without the channel ID) is the address of a known user of the system. This comparison is done without using the channel ID **110**, therefore the system must first parse the address. If the recipient's address is not an address of a known user, in step **606**, the system rejects the message and returns an "unknown user" message to the sender of the message. If the recipient's address is that of a known user, in step **608**, the modified Sendmail program checks the channels file **212** to determine whether the channel ID **110** in the incoming message is in the recipient's channels file. If the channel ID **110** is not in the recipient's channels file **212**, in step **610**, the system rejects the message and returns a "no permission" message to the sender. If the channel ID **110** in the incoming message is in the recipient's channels file **212**, in step **612**, the message is sent to the PCA **214** via the path **216**.

In step **614**, the PCA **214** determines whether this is the first message from this sender. If this is the first message from the sender, the PCA enters the "from" channel into the UCDB **226** in step **616**. This is entered in the correspondent channel field **406** illustrated in FIG. **4**. The correspondent address field **402** is also filled in at this time. The system then proceeds to step **618**. If, in step **614**, it is determined that this is not

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the first message from this sender, the system also proceeds to step **618**.

In step **618**, the PCA **214** strips off the channel IDs from the header information (i.e. "to", "from", "cc", etc.) in the message. The PCA **214** then sends the e-mail message to the mail client **228** via path **230** in step **620**. Referring now to FIG. **7** (and also in part to FIG. **2**), the process by which a user sends a message to a correspondent or a list of correspondents will now be described. In step **702**, the user composes a message. The message will have a "to" field and a "from" field in a header as is known in the art. This message may be to more than one recipient or to a list of recipients, including people on a "cc" list. In any case, in step **702**, the user sends the message from the mail client **228** to the PCA **214** through path **232**. Next, in step **704**, the PCA **214** extracts a list, called a "recipients list", of all the recipients who are to receive a copy of the e-mail message. In step **706**, the PCA **214** determines whether there are any recipients left on the recipients list. If there are no remaining recipients, the process ends at step **708**. If there are remaining recipients, in step **710**, the PCA **214** chooses the first recipient from the recipients list and removes that recipient from the recipient list.

In step **711**, the PCA **214** determines whether this is the first message sent to this recipient. If this is the first message to the recipient, the PCA enters a "to" (or own) channel into the UCDB **226** in step **713** which the PCA **214** automatically generates. This is entered in the own channel field **404** illustrated in FIG. **4**. In addition the correspondent address field **402** and correspondent channel field **406** (if any) are filled in at this time as necessary. In a preferred embodiment, the PCA creates a private channel (class 1). The PCA also automatically at this point creates an "own key" and enters it in the own key field **408** of the UCDB **226**. The system then proceeds to step **712**. If, in step **711**, it is determined that this is not the first message sent to this recipient, the system also proceeds to step **712**.

Next, in step **712**, the PCA **214** constructs a new version of the message, which is identical to the original version of the message, except that the "from" address includes the user's own channel identifier for that recipient and the recipient's address is replaced with the correspondent's channelized address in the message header. That is, a

channel ID **110** is added to that recipient's address. This information is taken from the UCDB **226**. In particular, as shown in FIG. **4**, the own channel address is taken from the own channel field **404** and the correspondent address is taken from the correspondent channel field **406**. Next, in step **714**, the PCA **214** sends the message to the mail server **202** and, in particular, the mail sender **210** via path **218**, indicating in the SMTP envelope the single intended recipient. The mail sender **210** then sends the message to the intended recipient in the network **200**. The system then returns to step **706** and determines whether any recipients are left on the recipients list. This continues until all recipients have been addressed and the message has been sent to all recipients. It should be noted that in step **712**, if the recipient does not use channels, the PCA **214** will not insert the correspondent's channel in the recipient's address, as there would be no need to.

It will be observed that the PCA **214** rewrites the headers and envelope information if any (e.g. SMTP) of each message as it comes in (step **618**, FIG. **6**) and goes out (steps **712** and **714**, FIG. **7**). Essentially, the PCA **214** removes the channel ID's from all addresses in incoming messages (excluding those, if any, in the body portion of the message) before serving the message to the mail client **228** (step **618**). This solves the problems relating to accidentally disclosing channel IDs to third parties when including a received message in an outgoing message such as when a reply or forward command is used. Thus, the user need not worry about editing the channels ID out of the message headers. Of course, since the message body is not altered by the PCA **214**, there may be channel IDs in the body. However, these channel IDs must have been manually inserted to appear there.

For outgoing messages, the PCA **214** puts back channel IDs selectively before forwarding the message to the mail server **202** (step **712**). For a single recipient message, the PCA **214** simply puts the channel ID of the recipient into the recipient (or "to") fields (obtained in the correspondent channel field **406** of the UCDB **226**), and the return (or "own") channel allocated to the recipient into the address in the sender (or "from") field (step **712**). Multi-recipient messages are copied, and each copy is tailored (as in the single-recipient case) to a specific recipient (steps **706, 710, 712**). Then each tailored copy is sent to the designated recipient using a tailored

SMTP envelope (step **714**). This solves the problem of different recipients obtaining improper access to the recipient's private channels, because each recipient sees only information she already knows.

Thus, to the user of a PCA **214**, virtually all messages appear without channel IDs, and hence e-mail looks and feels like traditional e-mail. This is illustrated in FIGs. **8A** and **8B**. FIG. **8A** shows a version of an e-mail message that the sender and/or receiver actually views if they are both using a PCA **214**. The sender merely inputs the "From" address or field **802**, in this case "hall@research.att.com". This may preferably be automatically inserted by the mail client program. The user also inputs (possibly by using a keyboard) the "To" field **803**, in this case "frobboz@geewhiz.com", and the "Cc" field **804**, which is in this case "jrandom@j.r.isp.net." The user may then input his message body **805**. The PCA **214** converts this to what is shown in FIG. **8B** for transmission to the recipient in the "To" field **803a**. The PCA **214** adds to the "From" field **802a** a channel identifier **810** and adds to the "To" field **803a** a channel identifier **812** as described above. It should be noted that no channel identifier is added to the "Cc" field **804a** because the first copy of this message will be sent to the recipient indicated in the "To" field **803a**. Thus, there is no need for the "To" recipient **804a** to receive the channel ID of the "Cc" recipient. The PCA **214** will then generate another version of this message to the "Cc" recipient **804a** in which a channel ID will be inserted for the "Cc" recipient **804a** but will be removed for the "To" recipient **803a**. As can be seen in FIG. **8B**, the message body itself **805a** has not been changed. Upon receipt of the message, the PCA **214a** will strip out the channel identifiers **810** and **812**, and the message will appear again as in FIG. **8A**.

Occasionally, it may be desirable to switch a correspondent from one channel to another, either because the old, multi-user channel is known to too many adversaries, or because the user wishes to "upgrade" that correspondent's access, for example from public to private (or in another embodiment, temporary to permanent). If the correspondent does not use a PCA **214**, this requires notifying the correspondent to make a manual change in the correspondent's address book. In this case, the PCA **214** can help only in automatically sending out a notification as a normal message. However, if the correspondent also uses a PCA **214**, the

switching may be automated via the channel switching protocol shown in FIG. **9**. This allows the user's PCA **214** to make a change in the correspondent-address map of the correspondent's UCDB **226a**.

In a preferred embodiment, when both a user and a sender have PCAs (for example **214** and **214a** in FIG. 2), the channel switching protocol of FIG. **9** may be used. To use this protocol, the user (**108**, FIG. **1B**) and host (**112**, FIG. **1B**) parts of the address must remain the same. The PCA will only change the channel ID part (**110**, FIG. **1B**). This prohibits an adversary from, for example, tricking a PCA **214** into sending private messages to an embarrassing public forum. Also, in a preferred embodiment, the PCA **214** will be configured to allow channel changes only when the channel class indicator **116** does not increase in magnitude. Thus, for example, a private channel cannot be switched to a public channel. Thus, assuming the user's attention is higher for lower-numbered channel classes, the PCA **214** will not be tricked into downgrading a correspondent so that messages might be ignored longer than expected.

The protocol illustrated in FIG. **9** may secure against attacks by "non-eavesdroppers." Moreover, channel switches caused by eavesdroppers (e.g., those who are listening on or tapping the communication line) may be detected and the parties notified so that appropriate action may be taken.

Referring now to FIG. **9** and FIGs. **10A**, **10B**, **10C**, **10D and 10E**, the process for switching a channel when a user and a correspondent both have PCAs will now be described. In FIG. **9**, the letter "A" refers to a user who wishes to change a channel that a correspondent, referred to as "B", uses for sending e-mail to user A. When referring to FIGS. **10A** through **10E**, user "B" is represented by "frobboz-1DDYWA7H7I-@geewhiz.com". Similarly, in FIGS. **10A** through **10E**, user A is represented by "someone-1QXR7112PH-@domain.com". In addition, FIG. **2** should also be referred to wherein it will be assumed by way of example that A is using user machine **206** and B is using user machine **206a**.

Once a user (A) has decided that he wants to switch the channel that a correspondent (B) uses to communicate with the user (A), the system first, in step **901**, creates and opens a new channel to be switched to. The new channel is placed in the channels file. Next, the system

determines in step **902** whether correspondent B's key is located in user A's UCDB **226**. In particular, the key would be located in the "correspondent key" field **410**. If not, user A's PCA **214** sends a message to correspondent B's PCA **214a** requesting correspondent B's key in step **904**. The message also includes user A's key so that correspondent B can include it in the reply. This message is illustrated in FIG. **10A** wherein a "send your key" message **1001** is sent. User A's key **1002** is included in this message.

Next, in step **906**, correspondent B's PCA **214A** sends user A's PCA **214** correspondent B's key and includes user A's key in the message. User A's key has been copied from user A's previous message (FIG. **10A**). This allows user A to know that correspondent B's message is legitimate. In step **906**, A's channelized address and B's key are taken from B's UCDB **226a**. If B's UCDB **226a** has no entry for user A, the message in step **906** is not sent. FIG. **10B** illustrates the message sent in step **906**. Correspondent B is sending a "my key is" message **1004** to user A so that user A acquires correspondent B's key, in this case "T7AA18MMN". In the message, user A's key **1006** is included for authentication. User A's PCA **214** records correspondent B's key in user A's UCDB **226** in step **908**.

The system next proceeds to step **910**, which is also where the system would proceed if in step **902** it was determined that correspondent B's key was already located in user A's UCDB **226**. In step **910**, user A's PCA **214** sends a message to correspondent B's PCA **214a** to switch to a new channel. User A's PCA **214** sends a copy of correspondent B's key as well as A's own key in this message. Such a message is illustrated in FIG. **10C**. In FIG. **10C**, the message to change channels to a new channel **1008**, in this case "1L3RG3592T", is forwarded to correspondent B. Included with this message is a copy of correspondent B's key **1010** so that user B knows correspondent A's message is legitimate. A's key is also included **1006**.

Next, in step **912**, correspondent B's PCA **214a** changes correspondent B's UCDB **226a** to reflect the new channel to be used to correspond with user A. Also, in step **912**, correspondent B's PCA **214a** sends an acknowledgment on the old channel to user A that the channel has been changed. The acknowledgement message includes a copy of user B's key for authentication as well as a copy of A's key. This type of message is

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illustrated in FIG. **10D**. In FIG. **10D**, an acknowledgement message **1011** is sent along with user B's key **1010** and A's key **1006** as well as the new channel **1012**.

Next, in step **914**, user A's PCA **214** closes the old channel for correspondent B and sets the new channel as B's channel in user A's UCDB **226**. Following this, an exemplary message that could be sent from user A to correspondent B is illustrated in FIG. **10E**. It should be noted that the new channel identifier **1016** is placed in the "To" field for sending to the user (A) who has switched channels.

This protocol illustrated in FIG. **9** can be used to detect eavesdroppers. For example, if user A's PCA **214** receives a second "my key is" message (for example like that shown in FIG. **10B**) indicating correspondent B's key, as in step **906**, which message includes user A's valid key, but a different key is indicated for correspondent B, then user A knows that an eavesdropper has sent one of these two messages. Thus, an eavesdropper has been detected and user A may alert correspondent B of this situation. In addition, if user A's PCA **214** receives a "my key is" message (for example like that shown in FIG. **10B**) (as in step **906**) providing correspondent B's key that is not expected (i.e., step **904** has not occurred), then an eavesdropper detection can also be entered. Finally, if user A's PCA **214** receives an acknowledgement that a change in channels has occurred (for example like that shown in FIG. **10D**) with a valid key from correspondent B, but the change in channel is unexpected, then an eavesdropper detection condition is also entered. When an eavesdropper detection condition is entered, user A may notify correspondent B and appropriate action may be taken. This notification preferably should include correspondent B's key so that correspondent B will know the message is legitimate. This notification could also take place outside of the e-mail environment, for example, by telephone.

Whenever either PCA (**214** or **214a**) receives a channel switch message not containing a correct key, it ignores it.

Keys are generated in the manner described for channel IDs except that the channel class indicator (**116**, FIG. **1**) is omitted. The PCA **214** generates the own key when an entry for a correspondent or channel is created in the UCDB. In a preferred embodiment, the PCA generates a different key for each correspondent/channel.

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In another embodiment, to accomplish channel switching the user's PCA **214** may send a digitally signed channel switch message containing the new channel ID to the PCA **214a** of the correspondent, which verifies authenticity of the message, carries out the change, and then sends a digitally signed acknowledgement back to the user's PCA **214** on the old channel, so that the user's PCA **214** knows when to close the old channel. A digital signature is a string attached to document that is a non-forgable, non-repudiatable "signature" of a document that reliably associates an individual with that document. Digital signatures can be implemented, for example, using PGP or S/MIME compliant applications mentioned above.

When a user needs to open, close, create, delete or switch channels, the user may use the PCA's administrative interface which is illustrated in FIG. **11**. The administrative interface may be used to allocate some new channels (for example for use in mailing lists or as temporary reply channels) or to close or switch channels. This administrative interface is used with the web browser **234** through path **236**. The PCA acts as a web server, formatting each page of the administrative interface in Hypertext Markup Language ("HTML") and transmitting it using HTTP over path **236**. This web interface allows the PCA **214** to be run on a machine different from the mail client **228** so that the user's mail client machine need not be connected to the network **200** in order for the PCA **214** to carry-out its processing. Moreover, existing browsers and mail clients, such as Netscape Navigator, available from Netscape Communications Corp. may be used with the PCA **214**, obviating the need for learning a new native interface. In a preferred embodiment, each user's administrative interface should be password protected.

Referring now to FIG. **11**, the administrative interface (shown as it would appear on a computer screen) provides a title **1101** indicating the owner of the UCDB **226** for which the interface has been accessed. The interface acts as a way to modify the UCDB **226**, which holds most of the relevant data used by the PCA **214** for a given system user. There are two main components of the interface, a channel map component **1102** and a correspondent address map component **1104**. The interface, in the channel map component **1102**, provides various buttons for creating a "public" channel **1106**, creating a "private" channel **1108**,

creating a "send only" channel **1110**, closing a channel **1112**, opening a channel **1114** and deleting a channel **1116**. To use buttons **1112, 1114,** or **1116**, the user must first select an entry from the channel map display **1118**.

The channel map display **1118**, displays as entries the various channels that are active for that user. For example, the first entry in the channel map display **1118** of FIG. **11** indicates various information for the correspondent "mybuddy@geewhiz.com". In this example, the channel that the correspondent must use to send mail to the user (hall@research.att.com) is "1B8SYC8YNL". There is also an indication that this is a private channel and that it is open. Note, that the third entry in the channel map display **1118**, which is accessed through channel "2BPDXY7P16", is a "public" channel as indicated. Therefore, no specific addresses are given for this channel because many users may send mail through the channel. The final entry on the channel map display **1118** is indicated as "closed." This means that no mail may be entered on this channel from a correspondent. Thus, any mail sent to this "closed" channel will be rejected by the PCA **214**. It should be noted that simply closing a channel does not remove it from the UCDB, it may be reopened later.

The correspondent address map **1104** provides buttons for deleting a correspondent **1120**, adding a correspondent **1122**, and switching channels **1124**. To use buttons **1120** or **1124**, an entry must first be selected from the correspondent address map display **1126**. The correspondent address map display **1126** provides various information to the user. For example, the first entry in the correspondent address map indicates the channel that "mybuddy@geewhiz.com" would use to send correspondence to the user; that is, "1B8SYC8YNL". In addition, the address that the user must use to send messages to this correspondent is indicated in its full form with the channel ID ("1GG8HIAQ7N") for sending to that correspondent.

The user interface may be used through a commonly known pointing device, such as mouse. The user "clicks" on the desired action (or entry or button) with a mouse as is known in the art. So, for example, if the user ("hall@research.att.com") desired to change the channel that "mybuddy-1GG8HIAQ7N-@geewhiz.com" used for sending mail to the user, the user would click on the entry for this correspondent on the correspondent address map display **1126**. Then the user would click on the

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"switch channel" button **1124** and the PCA **214** would perform the channel change as described above. As another example, if the user wanted to create a private channel, the user would click on the "create private" button **1108** and enter the necessary data (e.g., correspondent, etc.) by, for example, using a keyboard or other known data entry device.

In another embodiment, a PCA **214** and channelized addresses **106** may be used with Packet Telephony. Packet Telephony is usable over various networks, for example, the Internet. Used on the Internet, it is sometimes referred to as "Internet phone." Channelized addresses may be used in this environment since addresses are not restricted to the standard telephone format.

Referring to FIG. **12**, Packet Telephony may be used over a network **1202**. There are at least two exemplary possibilities for using PCA's in combination with such a network **1202** to provide Packet Telephony. The first embodiment may be used with a personal computer ("PC") **1204**. The PC **1204** includes a Packet Telephony server **1206** as is known in the art, but modified as described below with reference to FIG. **13**. The Packet Telephony server **1206** may preferably communicate with a voice input/output interface **1208**. This voice input/output interface **1208** may include a speaker and microphone as is known in the art. The voice input/output interface **1208** is accessible to a user **1210** for "talking to" and "listening to" other users of the network **1202**. The user would also have access to a web browser **1212**, which may be used to administer the PCA **1214** as described with respect to the previously-described embodiments. The PCA **1214** also communicates with and modifies and updates a channels file **1216**. The PCA **1214** also communicates with the Server **1206**. The channels file **1216** is read by the Packet Telephony server **1206**.

A telephone call may preferably be initiated using the web browser **1212** by providing a "place call" button on an administrative interface (similar to that shown in FIG. **11**). A user would select a correspondent entry from a correspondent address map display and then select the "place call" button.

Alternatively, a user could use a standard telephone **1218** to dial up a PCA **1214a** which is located remotely on a machine or computer **1217** at a service provider's facility. Using standard dual tone multifrequency ("DTMF") touch tones the user can place telephone calls

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with the telephone **1218**. To administer the PCA **1214a** so that it updates or changes a channels file **1216a** or a UCDB, the user may access the PCA remotely through a standard web browser **1212a** as described for the embodiment shown by **1204**, except that a "place call" button would not be needed. This web browser **1212a** may be located on a user's PC **1219**. Again, as with the embodiment shown by **1204**, the Packet Telephony server would be modified as described below.

The Packet Telephony servers **1206, 1206a** may communicate with the network **1202** as is known in the art. In both embodiments **1204, 1217**, the Packet Telephony server **1206, 1206a** would refer to the channels files **1216, 1216a** to determine whether or not an incoming call is to be accepted. In addition, although not shown in FIG. **12**, the PCA's **1214, 1214a** would each have a UCDB which would be the same as for the other embodiments described earlier. For outgoing calls, the UCDB may be referenced to add the appropriate channel ID (if any) to the intended recipient's address.

In FIG. **12**, a "third party" **1220** is shown for use in explaining how telephone calls may be sent to and received from that third party **1220**.

Referring now to FIG. **13** the process for receiving a packet telephone call, for example from third party **1220** will now be described. In this example, it is assumed that the call is directed to user **1210**, but an indication of how the call would proceed to the telephone **1218** is also indicated parenthetically. In step **1301**, the caller (third party **1220**) transmits a call set-up request including the user's address to the recipients/user's telephony server **1206** (or **1206a**). This will include the user's channel ID if the user uses channelized addresses for incoming calls.

In step **1302**, the user's telephony server **1206** (or **1206a**) checks the address sent by the third party **1220** to determine if the user it designates is an authorized user **1210** (or **1218**) for that system. If in step **1302** the server determines that the address does not designate an authorized user **1210** (or **1218**), the system refuses the call setup request in step **1303**. If it is determined in step **1302** that the user is an authorized user, then the process proceeds to step **1304**.

In step **1304**, the server **1206** (or **1206a**) checks the channels file **1216** (or **1216a**) and determines whether or not the channel ID provided

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by the third party **1220** is open. If the channel ID is not open, in step **1306**, the system will refuse the call set-up request from the third party. If, in step **1304** it is determined that the channel provided by the third party is valid and found as an open channel in the channels file **1216** (or **1216a**) the server **1206** (or **1206a**) will, in step **1308** set-up the call in a conventional manner. This will include in the embodiment shown by **1204** sending the information to the voice input/output interface **1208** so that the call may be listened to and responded to by the user **1210**. In the embodiment shown by **1217**, this will include ringing the user's telephone **1218** through the PCA **1214a** so that the user can pick up the telephone and communicate with the third party **1220**.

For the process illustrated by FIG. **13**, the packet telephony server **1206** (or **1206a**) is modified from those known in the art in that it separates the channel ID from the address and checks the channels file to see if the channel ID is in the channels file **1216** (or **1216a**). This check is done in addition to any other checks or processing that the server **1206** (or **1206a**) may also perform as is known in the art.

Referring now to FIG. **14**, the process for placing a packet telephone call from a standard telephone set **1218** (the embodiment shown by **1217**) will now be described. First, in step **1402**, the user dials on the telephone **1218** the access number of the PCA **1214a**. Next, in step **1404**, the user demonstrates that he is authorized to access the PCA **1214a**. This may be accomplished in a preferred embodiment, for example, by entering a "PIN" (personal identification number) number. In step **1406**, the user enters a touch tone sequence to identify the party to be called (or call recipient), for example a third party **1220**. This entry is accomplished using the standard touch tone keypad on the telephone **1218** and is entered into the PCA **1214a**. This may be accomplished using a standard 10-digit telephone number in one embodiment. In other embodiments, other addresses may be used.

In step **1408**, the PCA **1214a** determines whether the user/caller **1218** has a channel ID for the party to be called (or call recipient) in the user's/caller's UCDB. If there is an entry in the UCDB, in step **1410**, the PCA **1214a** places the call to a channelized telephone address of the caller. If, in step **1408**, it is determined that the caller does not have a channel ID for the call recipient in the UCDB then, in step **1412**, the PCA

1214a places the call to the original telephone number sequence entered by the user. Whether the PCA placed the call to a channelized telephone address in step **1410** or without a channelized telephone address in step **1412**, the call then proceeds in a conventional manner in step **1414**. That is, the call is sent to the recipient over the network and, if the recipient uses channelized addresses, the process described with respect to FIG. **13** occurs. If the call recipient does not use channelized addresses, the call proceeds as is known in the art.

The process for sending a telephone call for the embodiment shown by **1204** is similar to that described for the embodiment shown by **1217** with reference to FIG. **14**, except that steps **1402** and **1404** are not necessary and therefore omitted. Step **1406** is replaced by the user **1210** initiating the call by clicking "place call" in the administrative interface as described above.

It is understood that while a "PCA" has been described for the embodiments shown in FIGs. **12**, **13** and **14**, this PCA is different than the actual PCA used by the embodiments described earlier. The PCA of FIGs. **12**, **13** and **14** is similar in overall function to the PCA's of the other embodiments, but is configured to accommodate Packet Telephony. In another embodiment, the PCA may be configured to process both Packet Telephony calls and e-mail messages.

It is understood that the users sending packet telephone calls may use the standard ten digit telephone numbers, or longer numbers for overseas calls. In addition, the users may also use other types of addresses for sending calls to call recipients. These other types of addresses may comprise digits, letters, or any other combination thereof, including other types of characters. These other addresses may be longer (or shorter) than standard telephone numbers.

It is further understood that channelized addresses and PCAs according to the invention have many practical uses. For example, one may participate in a public forum, such as a mailing list or newsgroup, without giving away access information. At the time a user subscribes to a list, the user may send a public channel address to the list maintainer. All messages sent to the list (and therefore to the user) may be delivered on this public channel. To send a message to the list, however, the user sends the message from a "send-only" channel using a send-only address in the

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"from" header. Anyone wishing to reply must send the reply message to the list maintainer and thus to the entire list. If the user wishes to allow private replies, the user may allocate a limited-lifetime public channel and use it as the return address, perhaps explicitly indicating when it will be deactivated. People wishing to respond to a message sent to the list can do so privately for a short while, but firms collecting interest-based mailing lists will be left with closed channels after the timeout period. The user may always choose to "upgrade" a correspondent to a permanent channel once contact is made.

Channelized addresses and list servers on a network may be used together to implement private mailing lists. This would allow groups to confer without requiring that they all have direct channels to each other, while prohibiting outsiders from sending messages to the group. This may be implemented by establishing a list server with an unguessable (channelized) address known only to list members. List members need not have direct channels to each other. Therefore, this application may be useful, for example, when a single buyer needs to have a group discussion, such as an auction, with vendors who are mutually adversarial.

Channelized e-mail according to the invention may also enhance the effectiveness of e-mail filters and agents. This may be accomplished by providing a reliable categorization based on which classes of correspondents know which channels. For example, when filling out registration forms for products, one may use a particular public channel. Then, the filter could be instructed to classify all traffic on that channel as lower priority than traffic on more personal (or private) channels.

In a typical setting, the user's mail server and its local network should preferably not be systematically eavesdropped by an adversary. This is most likely the case, for example, when the server is run by a reputable commercial on-line service. In that case, the server, the filesystem containing the user's channels file, and at least part of the network will typically reside in locked or secure rooms and other hard-to-access places. System administration will presumably be competent and careful. Finally, the inherent risks and costs of breaking into such a secure server likely would not be justified by stealing easily changeable access channels. But, channelized addresses according to the invention do not require that the entire network be impervious to eavesdropping. For

example, it is plausible that one or more correspondents of a user may be "eavesdroppable." In this case, an adversary may gain access to the user by examining the messages of the legitimate correspondent. Moreover, since it is easy to forge Internet mail messages, it may be difficult to identify (at least initially) where the unauthorized messages are originating from or which correspondent "leaked" the channel ID. However, by systematically assigning correspondents to unique channels, the user can easily locate the leak. At that point, the user can deal with the correspondent directly to establish some means of authentication. For example, in an alternative embodiment, the legitimate correspondent could be assigned a channel and then a filter agent could accept messages on that channel only if the correspondent's digital signature can be verified.

Channelized addresses according to the invention may also be used without a PCA, but a PCA is preferred. The PCA eliminates the need to remember what channel to use as a return address for a particular correspondent. Also, when sending messages to multiple recipients, security is breached if one simply includes everyone's channelized addresses since it is unlikely all readers will be authorized for all of the other recipient's channels. For example, suppose one sends a message to a mailing list and cc's a friend's private channel address (because the friend does not read the list). The "Cc" will be visible to all list readers so they will all gain unauthorized access to the friend. The PCA eliminates all of these potential problems.

The PCA may also solve problems relating to replying to or forwarding messages. People frequently include a received message within a reply to, or forward of, the received message. If the original message contains channel IDs for recipients, then the user must remember (as a courtesy) to edit them out of the copied original. If the user has a PCA, the PCA will automatically take care of this.

It is understood that channelized addresses according to the invention may be used without a PCA. While a correspondent who does not use a PCA must directly use the user's channelized address which may be harder to remember, many mail clients provide for on-line address books or user-defined aliases, which would be used when a PCA is unavailable to simply address channelized e-mail. Using these address books or aliases will not solve all of the problems eliminated by the PCA, for example,

when sending a "Cc" and reply, the channel ID may be "leaked" when the correspondent sends a multi-recipient message. In addition, automatic channel switching as described with reference to FIG. 9 is not provided for if the correspondent does not have a PCA. In this case, the user's PCA may be configured to automatically generate notification to each desired correspondent regarding the changing channel. Each correspondent would then have to update her address book.

It is useful to notice when correspondents send messages on channels they are not authorized for so that "leaks" can be isolated when they become a problem. However, the problem may take a while to appear (as more and more junk traffic builds up on a channel), while the original leaks will be long forgotten. In a preferred embodiment, the PCA checks each incoming message to determine whether the sender is authorized to send messages on the channel the message arrived on. Specifically, messages to private channels are checked to see whether the sender is a "member" of the channel. If not, the user is notified (preferably only once for a given user and channel) and the event is logged in the UCDB. This is not done for public channels because one expects previously unknown correspondents to send messages on public channels.

Channelized addresses according to the invention may also resolve a possible dilemma caused by directories of e-mail addresses. An approach based on not telling everyone how to reach the user conflicts with the idea of directories, which tells everyone how to reach the user. Channelized addresses may actually help resolve this tension because one might be more willing to publish an easily changeable address than a permanent address. If traffic on a particular channel becomes voluminous (or "noisy"), the user may deactivate the published channel and (if desired) publish a replacement channel.

In another embodiment, channelized addresses according to the invention may be used in combination with cryptographic authentication. Cryptographically authenticated messages may be received on a public channel as an alternative to private channels for those users who wish to use cryptography. In addition, in an alternative embodiment, the user could create an "authenticated channel". Here, a filter rejects messages that are not digitally signed by an expected correspondent. An authenticated channel could even have a well-known channel ID such as

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"1AUTHENTIC" since unauthenticated messages are discarded unseen.

In the presently preferred embodiment, each correspondent is preferably allowed at most one channel, although it is understood that multiple channels may be assigned to a single correspondent. While it may seem desirable to allow multiple channels per correspondent (for example, for different purposes), no security is gained by a single individual knowing two or more access channels for a correspondent. Instead, the logical separation of traffic from a single user may be implemented in an alternative embodiment using existing e-mail filtering techniques known in the art. In such combined architectures, an extended UCDB may accommodate the needs of both channels and e-mail filters by allowing multiple channels per correspondent. In this configuration, one channel should preferably be designated as the default for use when rewriting header and envelope information in outgoing messages.

In the presently preferred embodiment, the system rewrites the header information and (when applicable) the SMTP envelope information by adding/deleting channelized addresses. In an alternative embodiment, the system may simply rewrite the envelope information with the channelized address and leave the header information alone.

It is understood that rewriting the header information in addition to the envelope information may be preferable due to the ability to operate with non-channel using correspondents and non-SMTP mailers as well as user convenience. A non-channel using correspondent expects a valid return address (in order to be able to use the client's reply command, for example) to appear in the "From" field (part of the header) of a message. Thus, if a PCA does not rewrite the header, the non-channel using correspondent may not receive the channel ID. Also, the non-channel using correspondent will provide a channelized address in the "To" field (part of the header) when originating a message. If the PCA is not configured to remove this channelized address from the header, security problems may result if the recipient forwards or replies to the message without manually removing the non-channel using correspondent's address from the message.

If the PCA does not rewrite the header but only the envelope, some non-SMTP mail systems may not be able to process the message if these systems do not separate header information from envelope

information. For these mail systems to process the message, the correct addresses must appear in the header.

In the preferred embodiment, one convenient way for a user of channelized addresses and a PCA to enter a new correspondent's channelized address into the UCDB for the first time is to type or otherwise input the full address into the "To" field of the outgoing message. The PCA can then record it as it passes through untouched. Subsequent messages may be rewritten by the PCA so that the user need no longer type in the channel ID part of the address. If the PCA did not rewrite header information, this convenience may be limited or eliminated. In addition, a PCA can infer a correspondent's channelized address when one is not known (in the UCDB) by reading it in the "From" field of a received message. If header information was not processed by the PCA, this convenience may also be limited or eliminated.

In an alternative embodiment, the channel ID may be placed in some other field of the message header. It is understood that this alternative is less preferable when a user wishes to use mailing lists because each contributor to the list may have to include channel IDs for all recipients. This may be a difficult task. In this alternative embodiment, a sophisticated list manager may be used to store the appropriate channel ID for each address subscribed and make a tailored copy of each message for each recipient. Currently, no existing list servers are known that operate in this manner. On the other hand, putting the channel ID in the address allows the channelized addresses to operate together with existing list servers.

As compared to prior art methods, channelized addresses or channels according to the invention offer many advantages. For example, as compared to "kill files," it is possible with channels to grant access individually or as a group to any set of individuals, while denying access to others. Forgery does not help an adversary evade the channel mechanism of the present invention. As compared to filters, any message that arrives must have the specific channel ID. No detailed searching of the content of the actual message is necessary.

Channels also allow the user to absolutely "shut off" the flow of messages from an adversary by closing all channels known to that adversary. To gain unauthorized access, the adversary must invest

significant effort, risk, or money in eavesdropping or social engineering, while access can easily be prevented once again after receipt of one unwanted message.

It is to be understood that the above description is only of the preferred embodiments of the invention. Numerous other arrangements may be derived by one skilled in the art, without departing from the spirit and scope of the invention. The invention is thus limited only as defined in the accompanying claims.

I claim:

1. A method for sending a message from a sender to a recipient in a network, comprising the step of:

uusing an address to send the message from the sender to the recipient wherein the address comprises a common address portion that indicates the identity of the recipient in the network and a channel identifier portion for verifying that the message is authorized for delivery to the recipient.

2. The method of claim 1, wherein the message is an e-mail message.

3. The method of claim 1, wherein the message is a packet telephone call.

4. The method of claim 1, wherein the channel identifier portion comprises a substantially unguessable portion.

5. The method of claim 4, wherein the substantially unguessable portion is generated using random number generation.

6. The method of claim 4, wherein the substantially unguessable portion is generated using pseudorandom number generation.

7. The method of claim 4, wherein the substantially unguessable portion is generated by a user selecting the unguessable portion.

8. The method of claim 1, wherein establishing the channel identifier portion is controlled by the recipient.

9. The method of claim 1, wherein the channel identifier portion comprises a channel class indicator indicative of a class of message to be treated by the recipient in a predetermined manner.

10. The method of claim 9, wherein the channel identifier portion also comprises a substantially unguessable portion.

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11. An improved address of the type having a hierarchy of names including a lowest-level name at the lowest level of the hierarchy, the improved address comprising a channel identifier part of the lowest-level name that includes at least a substantially unguessable channel identifier.

12. The improved address of claim 11, wherein the improved address is an e-mail address and the lowest-level name is a user name.

13. The improved address of claim 11, wherein the improved address is a telephone number for packet telephony.

14. The improved address of claim 11, wherein the channel identifier part further includes a channel class indicator which indicates at least how a recipient is to treat a received message which has the improved address.

15. The improved address of claim 14, wherein the channel class indicator indicates classes of messages that may be any one of public, private and send-only.

16. A system for authenticating a received message from a network, the message having an address attached to it, comprising:

a mail server for receiving and authenticating the message; and

a file available to the mail server for determining whether the message is an authorized message, wherein the determination is based upon a substantially unguessable portion of the address attached to the message.

17. The system of claim 16, wherein the message is an e-mail message.

18. The system of claim 16, wherein the message is a packet telephone call.

19. The system of claim 16, wherein establishing the substantially unguessable portion is controlled by a recipient of the message.

20. The system of claim 16, wherein the substantially unguessable portion is generated using random number generation.

21. The system of claim 16, wherein the substantially unguessable portion is generated using pseudorandom number generation.

22. The system of claim 16, wherein the substantially unguessable portion is generated by a user selecting the substantially unguessable portion.

23. The system of claim 16, wherein the substantially unguessable portion comprises a channel class indicator indicative of a class of message to be treated by the recipient in a predetermined manner.

24. The system of claim 16, further comprising a personal channel agent.

25. The system of claim 24, wherein the personal channel agent automatically removes the substantially unguessable portion from the message before delivering the message to a recipient.

26. The system of claim 24, wherein the personal channel agent accesses a database containing at least one or more substantially unguessable portions corresponding to one or more correspondents.

27. The system of claim 24, further comprising a web browser for administering the personal channel agent.

28. The system of claim 24, further comprising an administrative interface for administering the personal channel agent.

29. The system of claim 24, further comprising a user machine for displaying the message on a screen.

30. The system of claim 29, wherein the user machine is a

personal computer.

31. The system of claim 29, wherein the user machine comprises a mail client for receiving the message.

32. The system of claim 16. further comprising means for changing the substantially unguessable portion so that a new substantially unguessable portion is established for determining whether the message is an authorized message.

33. The system of claim 32, wherein the means for changing the substantially unguessable portion is a personal channel agent.

34. The system of claim 33, wherein a key is required for changing the substantially unguessable portion.

35. The system of claim 34, wherein the key is provided by a recipient of the message.

36. The system of claim 33, wherein a first key and a second key are required to change the substantially unguessable portion.

37. The system of claim 36, wherein the first key is provided by a sender of the message and the second key is provided by a recipient of the message.

38. A system for sending a message on a network to a recipient, comprising:

a personal channel agent for automatically including a substantially unguessable portion in a recipient's address so that the recipient can determine whether the message is an authorized message that the recipient will receive.

39. The system of claim 38, wherein the message is an e-mail message.

40. The system of claim 38, wherein the message is a packet telephone call.

41. The system of claim 38, wherein establishing the substantially unguessable portion is controlled by the recipient.

42. The system of claim 41, wherein the substantially unguessable portion is generated by the recipient's personal channel agent using random number generation.

43. The system of claim 41, wherein the substantially unguessable portion is generated by the recipient's personal channel agent using pseudorandom number generation.

44. The system of claim 41, wherein the substantially unguessable portion is generated by the recipient selecting the substantially unguessable portion.

45. The system of claim 38, wherein the substantially unguessable portion comprises a channel class indicator indicative of a class of message to be treated by the recipient in a predetermined manner.

46. The system of claim 38, wherein the system further comprises a mail server.

47. The system of claim 38, wherein the personal channel agent includes the substantially unguessable portion by referring to a database.

48. The system of claim 47, wherein the database contains at least one or more substantially unguessable portions corresponding to one or more correspondents.

49. The system of claim 38, wherein the personal channel agent is administered using a web browser.

50. The system of claim 38, wherein an administrative interface

is provided for administering the personal channel agent.

51. The system of claim 38, further comprising a user machine for inputting the message.

52. The system of claim 51, wherein the user machine is a personal computer.

53. The system of claim 51, wherein the user machine comprises a mail client for transmitting the message to the personal channel agent.

54. The system of claim 53, further comprising a mail server for transmitting the message from the personal channel agent to the network.

55. A method of sending and receiving messages from one or more first correspondents to a second correspondent comprising the steps performed in a message transmission apparatus of:

the second correspondent forming a plurality of substantially unguessable extended addresses for messages sent from the one or more first correspondents to the second correspondent; and

providing a received message to the second correspondent only if an address to the second correspondent associated with the received message matches one of the plurality of extended addresses.

56. The method of claim 55, further comprising the step of automatically adding an extended address as a return address of a first message when the second correspondent sends the first message to a first correspondent.

57. The method of claim 56, further comprising the step of the first correspondent storing the extended address from the first message.

58. The method of claim 57, further comprising the step of the first correspondent automatically adding the extended address from the first message to the address to the second correspondent.

59. The method of claim 55 further comprising the step of a first

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correspondent automatically adding an extended address to the address to the second correspondent.

60. The method of claim 55, further comprising the step of forwarding the received message to the second correspondent.

61. The method of claim 55, further comprising the step of automatically removing an extended portion of one of the plurality of substantially unguessable extended addresses.

62. The method of claim 55, further comprising the step of automatically removing any extended portions of any addresses.

63. The method of claim 55, wherein the extended address comprises an indication of a class of treatment for the messages.

64. The method of claim 55, wherein the messages are e-mail messages.

65. The method of claim 55, wherein the messages are telephone messages.

66. The method of claim 55 further comprising the step of associating each of one or more of the extended addresses with one or more destination addresses for the one or more first correspondents.

67. The method of claim 66, wherein a single extended address is associated with a single first correspondent.

68. The method of claim 67, further comprising the step of changing the single extended address to a new extended address.

FIG. 1A
(PRIOR ART)

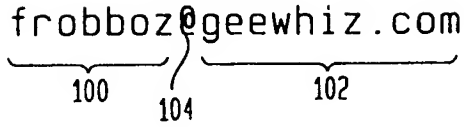


FIG. 1B

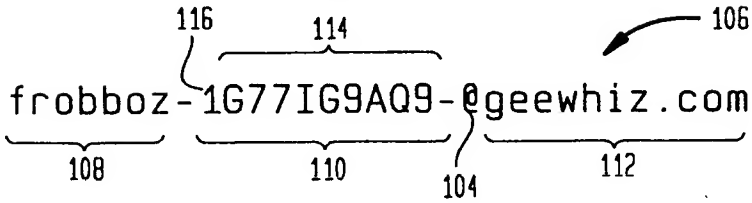
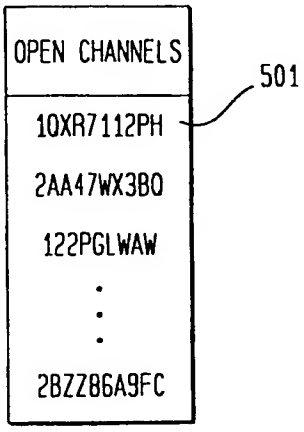


FIG. 4

402 CORRESPONDENT ADDRESS	404 OWN CHANNEL	406 CORRESPONDENT CHANNEL	408 OWN KEY	410 CORRESPONDENT KEY
frobboz@geewhiz.com	10XR7112PH	1DDYWA7H7I	X9GWAAH4T	T7AA18MMN
jrandom@j.r.isp.net	122PG3LWAW	1CJX449HKV	ADWKBSA92	
----------	2AA47WX3BO	----------	----------	----------
----------	2BZZ86A9FC	----------	----------	----------
	. . .			
info-hooha@sri.com	OXTRR9Y68O	----------	BZTGRTKI3	----------
	. . .			

FIG. 5



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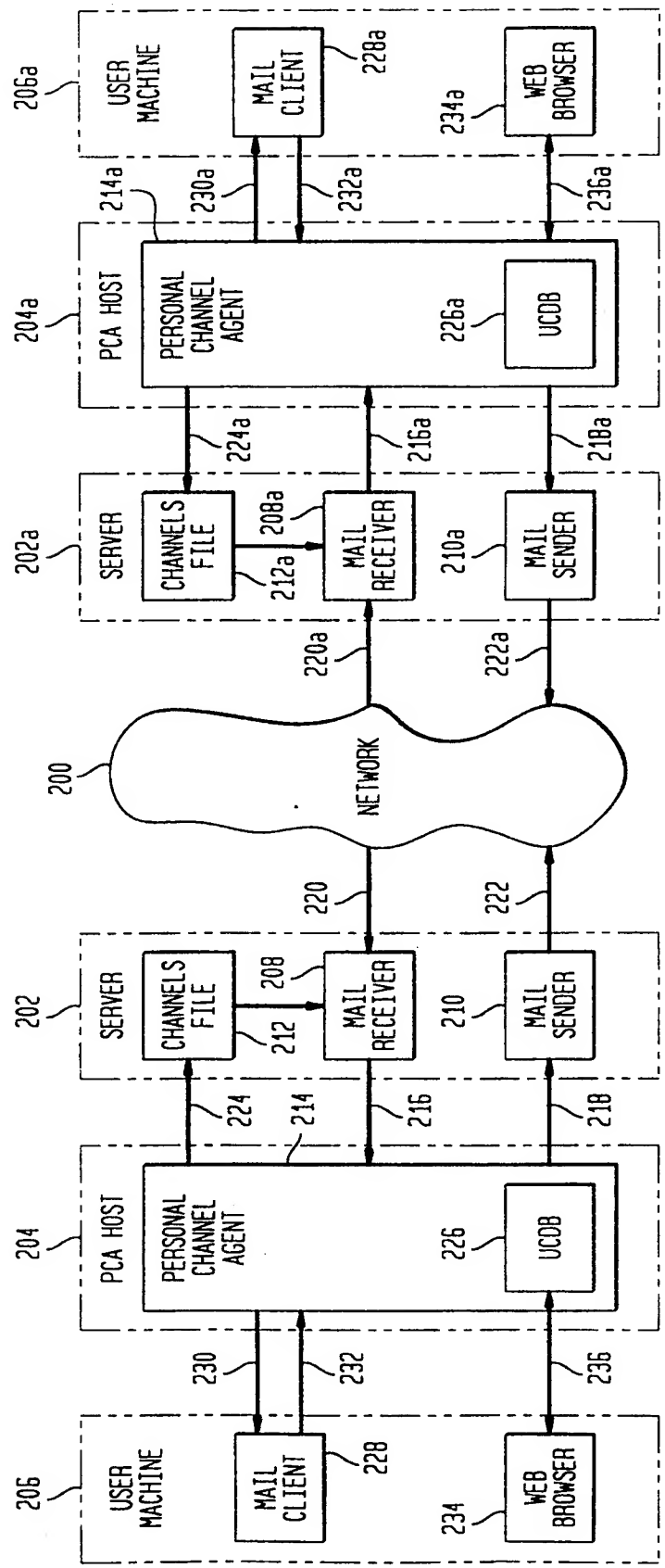
206a
USER MACHINE
MAIL CLIENT
228a
WEB BROWSER
234a
214a
230a
232a
236a
204a
PCA HOST
PERSONAL CHANNEL AGENT
UCDB
226a
224a
216a
218a
202a
SERVER
CHANNELS FILE
208a
MAIL RECEIVER
212a
MAIL SENDER
210a
220a
222a
200
NETWORK
220
222
202
SERVER
CHANNELS FILE
208
MAIL RECEIVER
212
MAIL SENDER
210
224
214
216
218
204
PCA HOST
PERSONAL CHANNEL AGENT
UCDB
226
230
232
236
206
USER MACHINE
MAIL CLIENT
228
WEB BROWSER
234

FIG. 2

FIG. 3

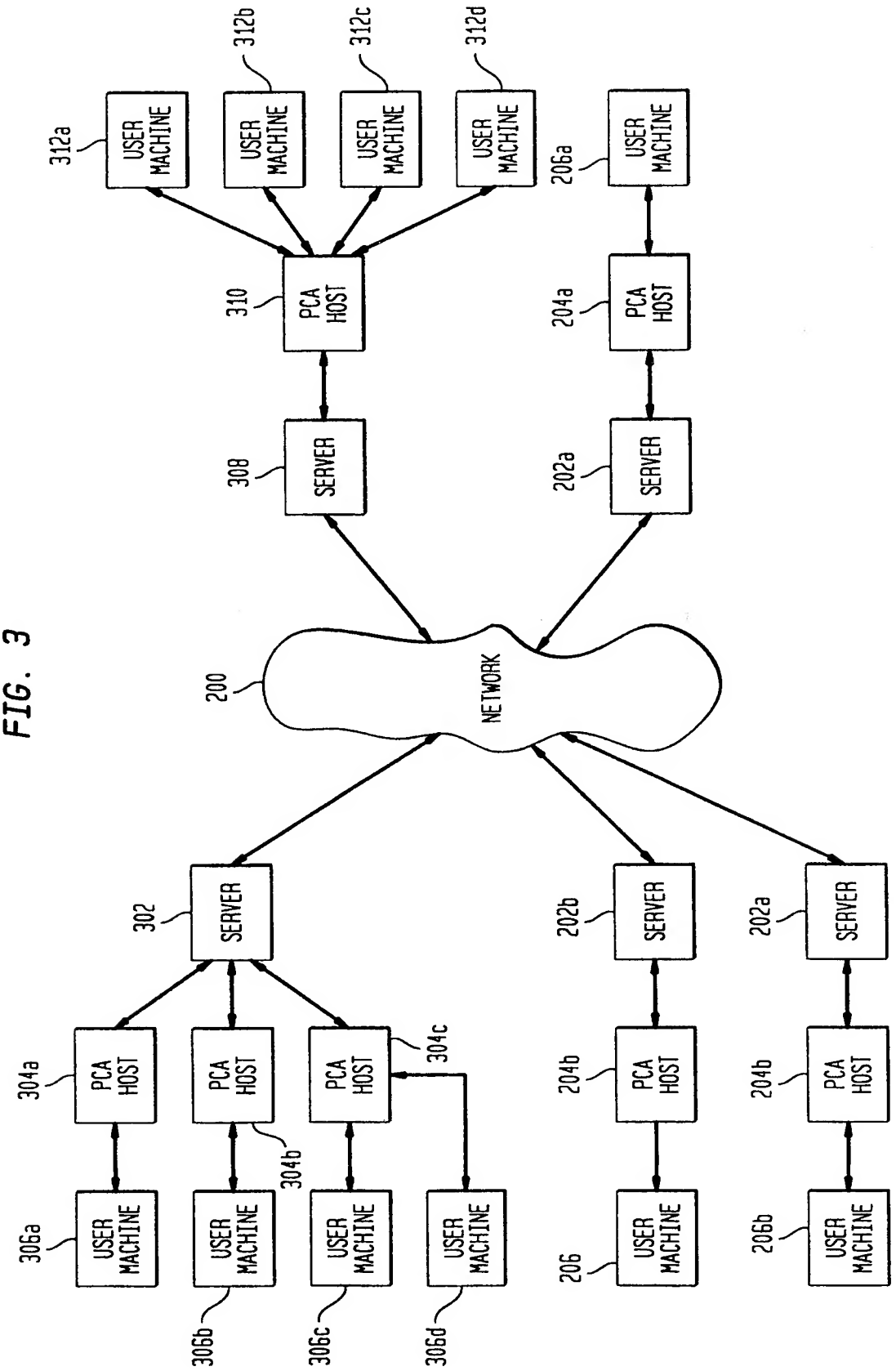

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FIG. 6

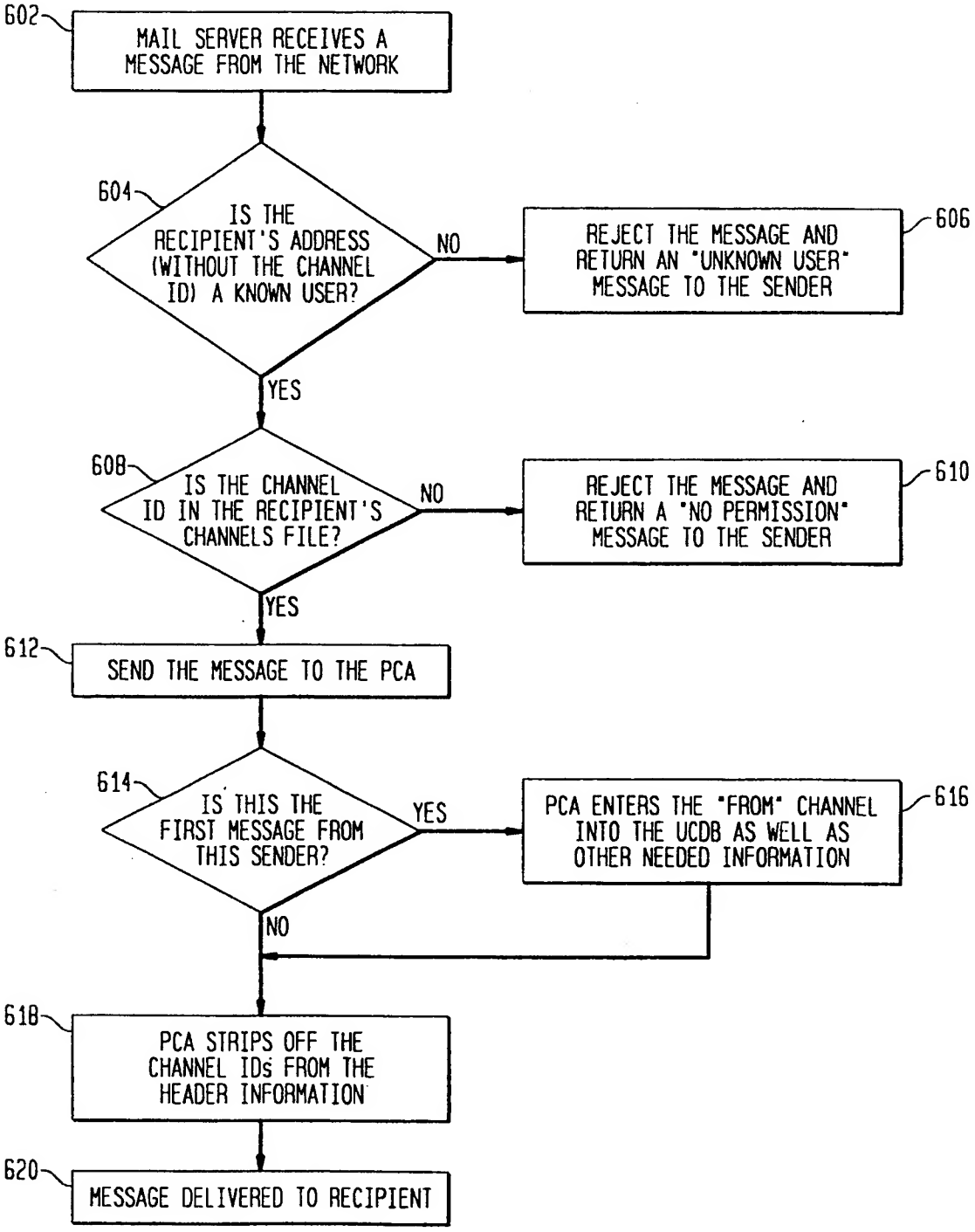
602
MAIL SERVER RECEIVES A MESSAGE FROM THE NETWORK
604
IS THE RECIPIENT'S ADDRESS (WITHOUT THE CHANNEL ID) A KNOWN USER?
NO
606
REJECT THE MESSAGE AND RETURN AN "UNKNOWN USER" MESSAGE TO THE SENDER
YES
608
IS THE CHANNEL ID IN THE RECIPIENT'S CHANNELS FILE?
NO
610
REJECT THE MESSAGE AND RETURN A "NO PERMISSION" MESSAGE TO THE SENDER
YES
612
SEND THE MESSAGE TO THE PCA
614
IS THIS THE FIRST MESSAGE FROM THIS SENDER?
YES
616
PCA ENTERS THE "FROM" CHANNEL INTO THE UCDB AS WELL AS OTHER NEEDED INFORMATION
NO
618
PCA STRIPS OFF THE CHANNEL IDs FROM THE HEADER INFORMATION
620
MESSAGE DELIVERED TO RECIPIENT

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FIG. 7

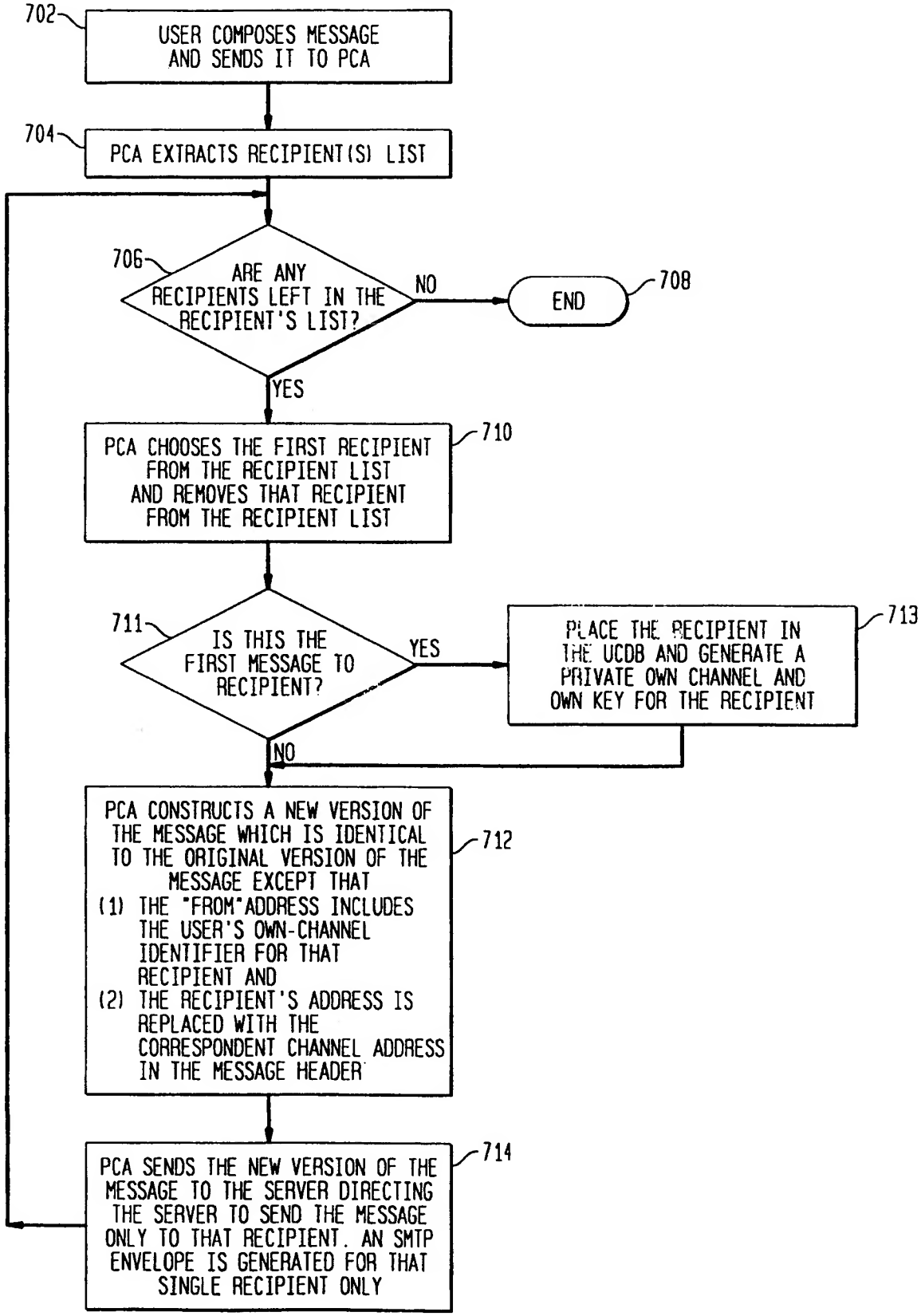

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FIG. 8A

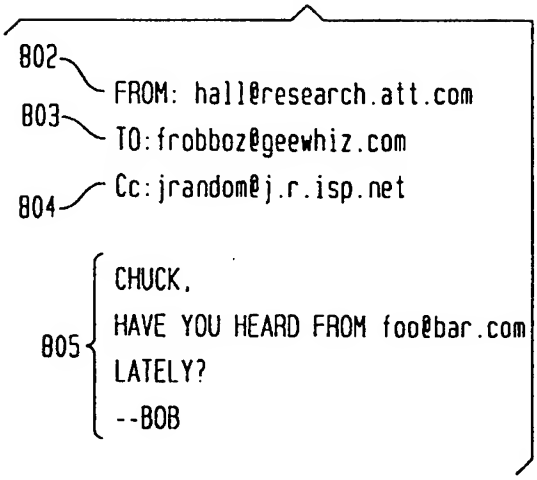

FIG. 8B

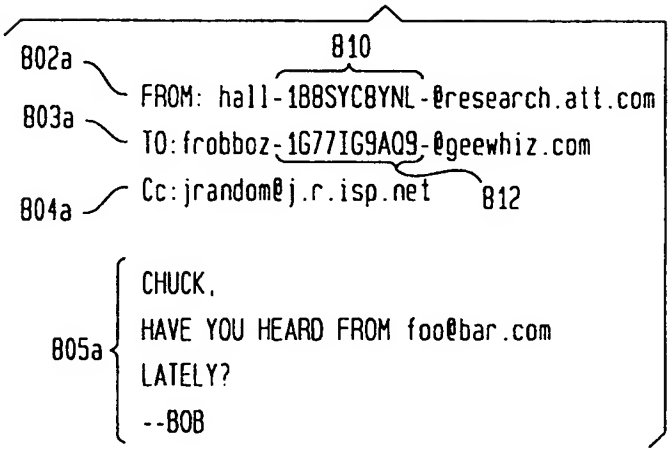

FIG. 10A

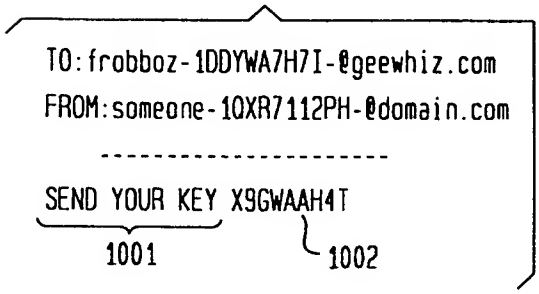

FIG. 10B

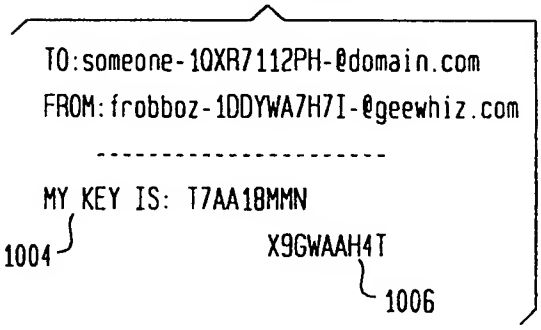

FIG. 10C

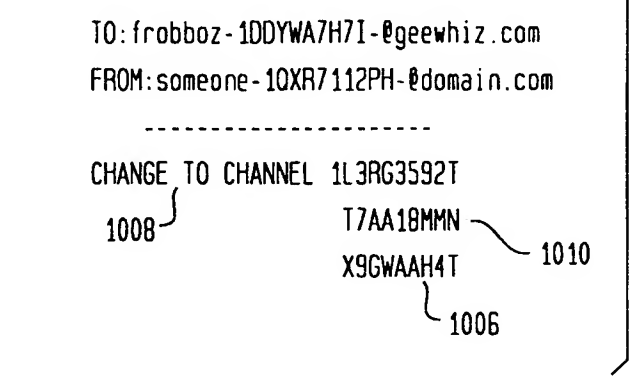

FIG. 10D

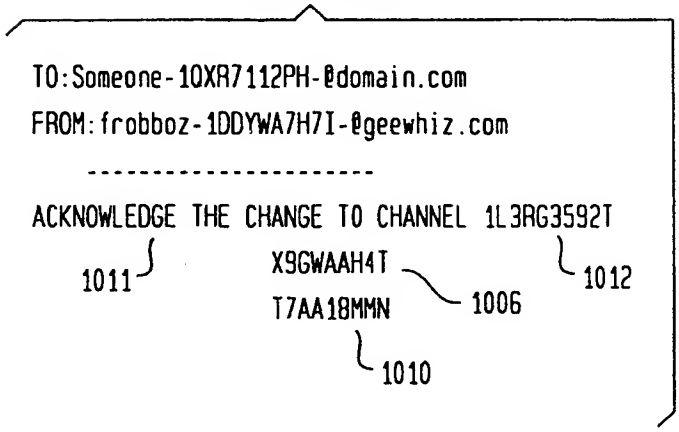

FIG. 10E

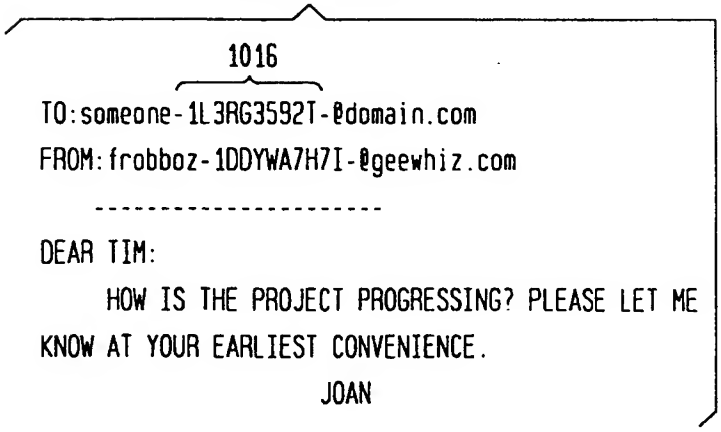

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FIG. 9

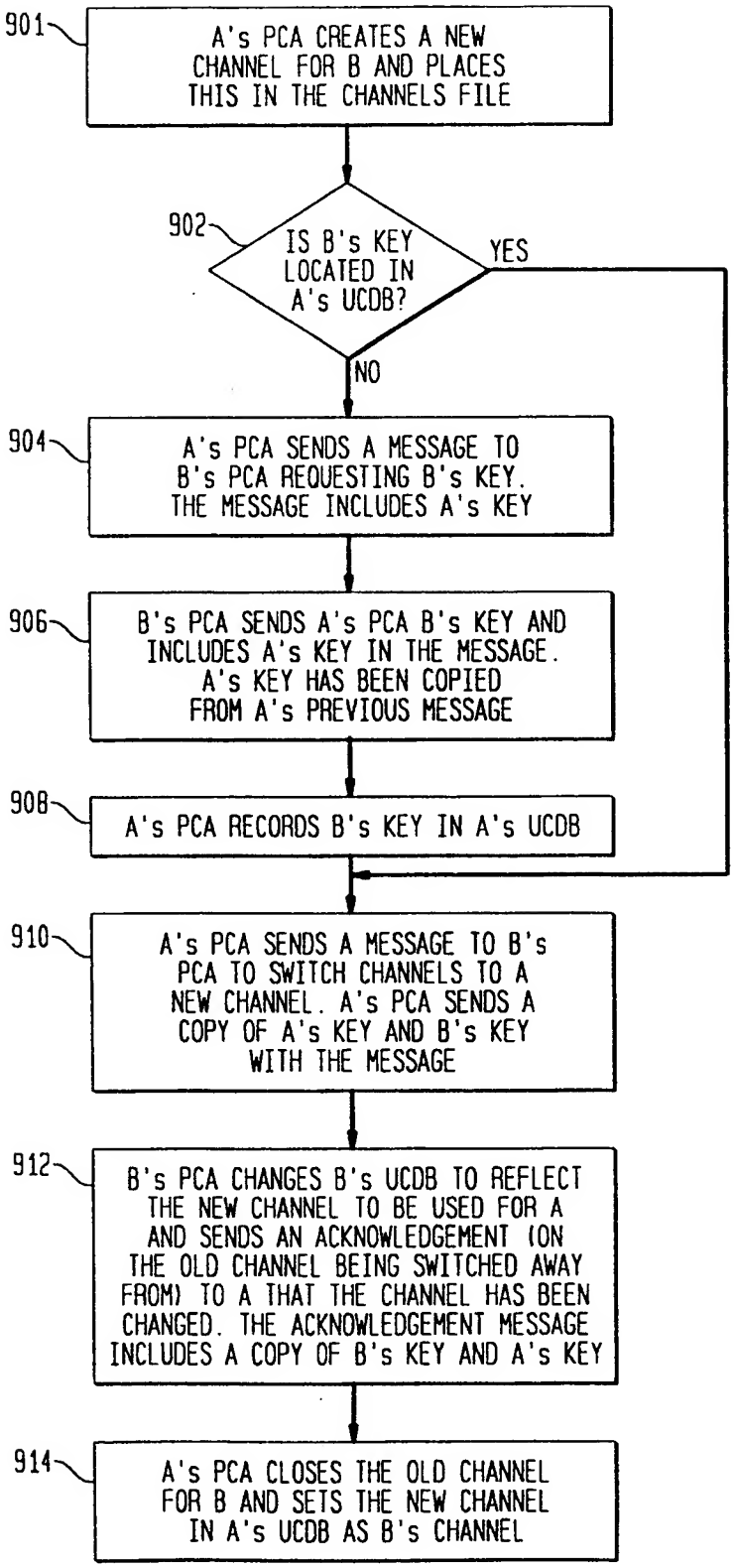

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FIG. 11

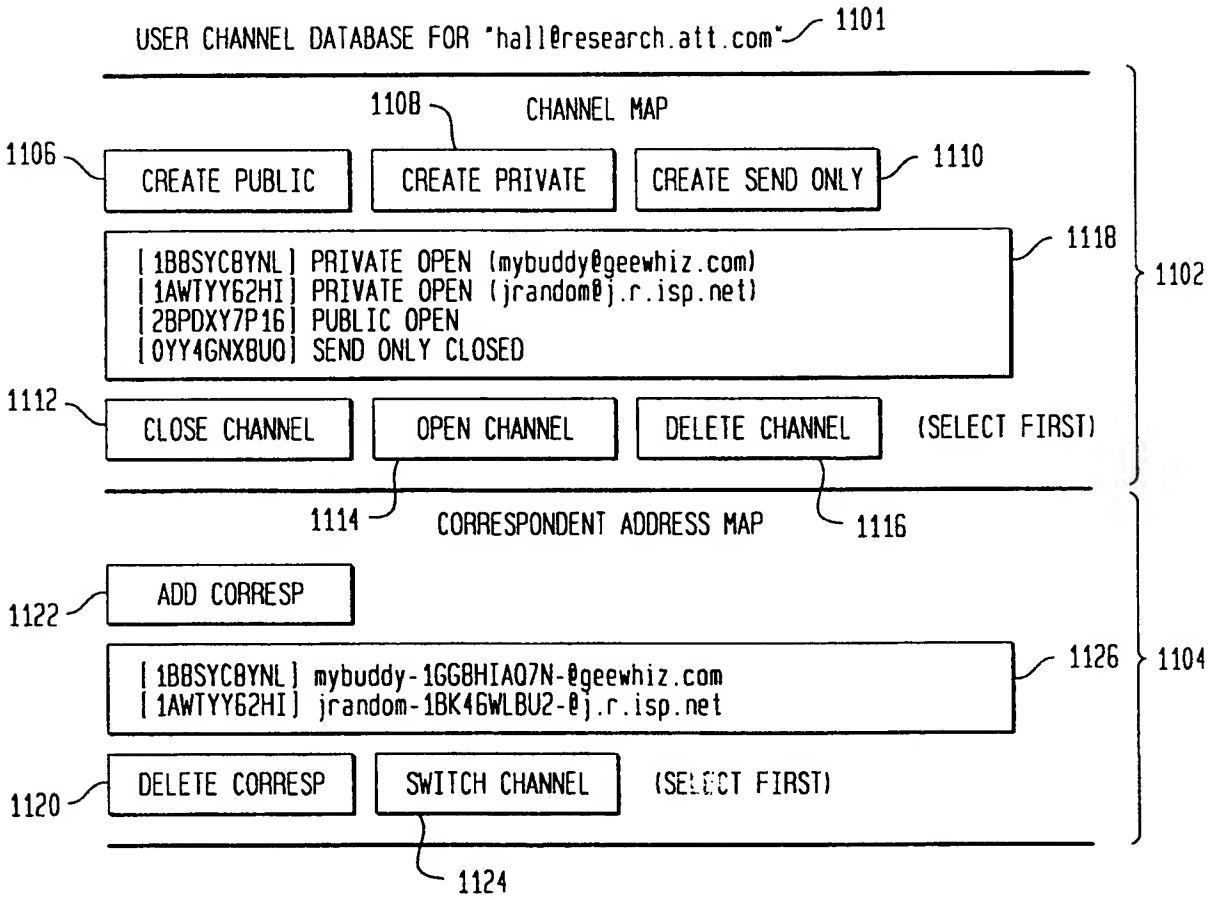

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FIG. 12

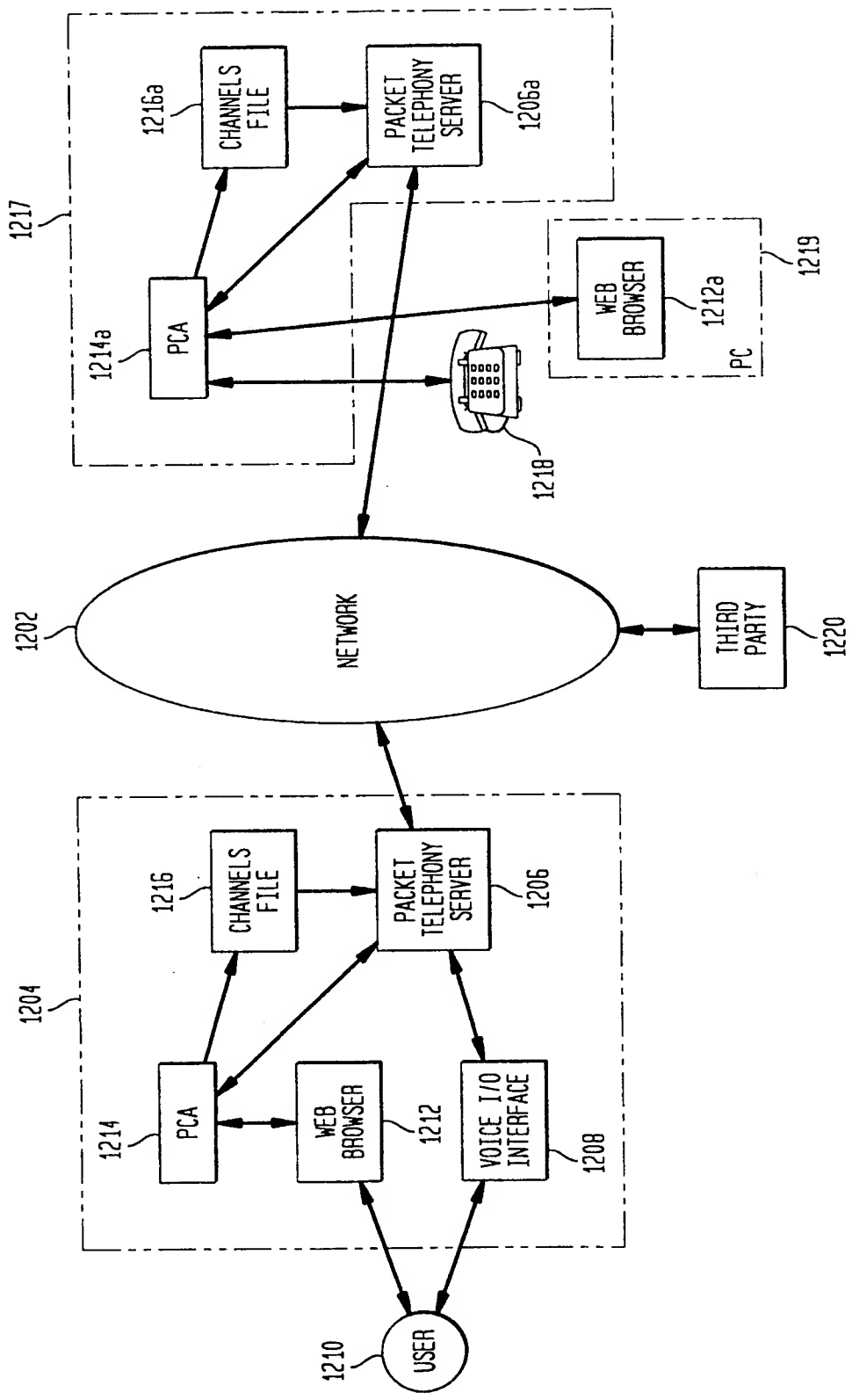

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FIG. 13

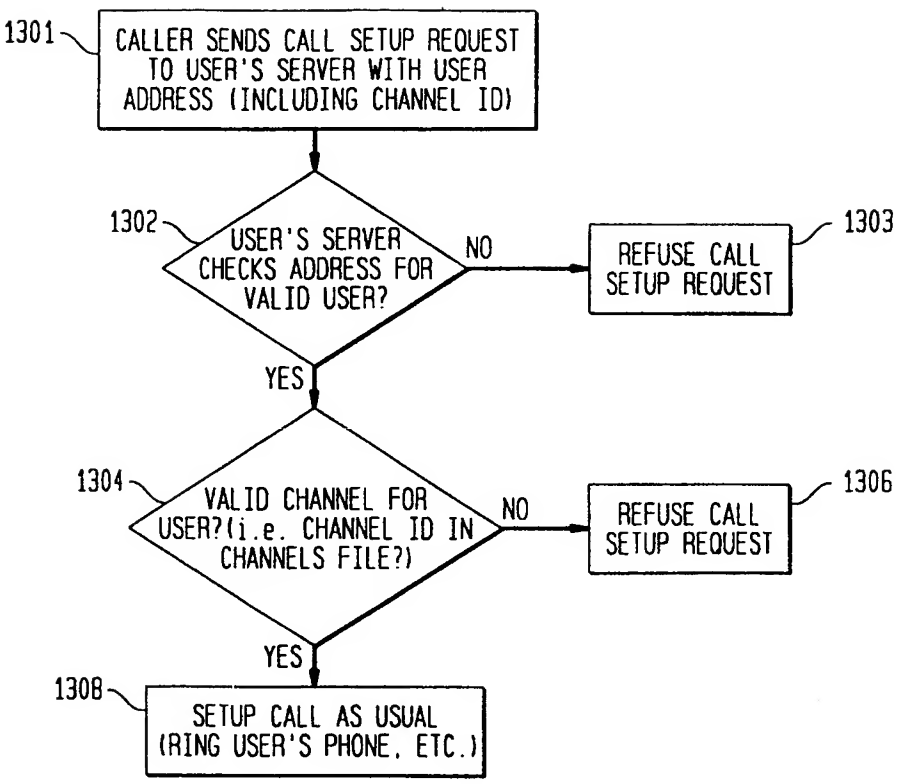
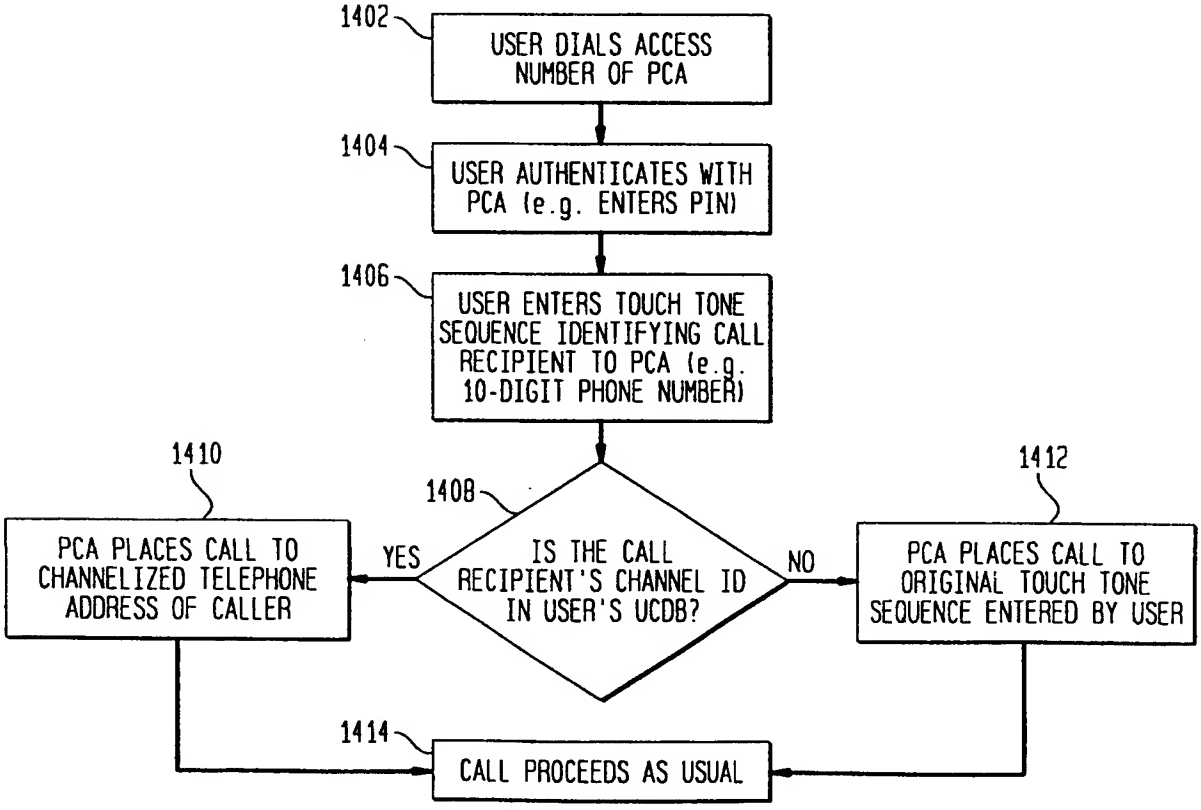


FIG. 14



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INTERNATIONAL SEARCH REPORT

Internatic Application No
PCT/US 97/18633

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L29/06 H04M3/50 H04L12/58

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F H04L H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KENT S: "RFC 1422" PRIVACY ENHANCEMENT FOR INTERNET ELECTRONIC MAIL: PART II: CERTIFICATE-BASED KEY MANAGEMENT, 1 February 1993, INTERNET ENGINEERING TASK FORCE, XP002058728 see paragraph 1 see paragraph 3.4.1.1 - paragraph 3.4.1.4	1,11,16, 38,55

☐ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search	Date of mailing of the international search report
13 March 1998	27/03/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Dupuis, H

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